JAN 7 1927

VOLUME III 1927 NUMBER 1

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ECONOMIC GEOGRAPHY

JANUARY

FISHERIES OF THE NORTH ATLANTIC

H. Matthews, *Production Manager, Atlantic Coast Fisheries Company*

THE COMMERCIAL GROWTH OF PERU
Clarence F. Jones, *Economic Geographer, Clark University*

AGRICULTURAL REGIONS OF NORTH AMERICA
Oliver E. Baker, *Agricultural Economist, U. S. Dept. of Agriculture*

A GEOGRAPHIC RECONNAISSANCE OF TRINIDAD
reston E. James, *Assistant Professor of Geography, University of Michigan*

GEOGRAPHIC ASPECTS OF THE PRINCE EDWARD ISLAND FUR INDUSTRY
F. A. Stilgenbauer, *Instructor in Geography, University of Michigan*

LARK UNIVERSITY, WORCESTER, MASSACHUSETTS, U.S.A.

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ECONOMIC GEOGRAPHY

CONTENTS FOR JANUARY, 1927

PAGE

FISHERIES OF THE NORTH ATLANTIC 1
J. H. MATTHEWS, *Production Manager, Atlantic Coast Fisheries Company*

THE COMMERCIAL GROWTH OF PERU 23
CLARENCE F. JONES, *Economic Geographer, Clark University*

AGRICULTURAL REGIONS OF NORTH AMERICA 50
PART II—THE SOUTH
OLIVER E. BAKER, *Agricultural Economist, U. S. Department of Agriculture, and Professor of Agricultural Geography, Clark University*

A GEOGRAPHIC RECONNAISSANCE OF TRINIDAD 87
PRESTON E. JAMES, *Assistant Professor of Geography, University of Michigan*

GEOGRAPHIC ASPECTS OF THE PRINCE EDWARD ISLAND FUR INDUSTRY . . 110
F. A. STILGENBAUER, *Instructor in Geography, University of Michigan*

BOOK REVIEWS 126–135

OUR CONTEMPORARIES 136–138

ECONOMIC GEOGRAPHY

Published Quarterly by

CLARK UNIVERSITY, at 10 Ferry Street, Concord, N. H.

Editorial Office: Clark University, Worcester, Massachusetts

PRICE $1.25 A NUMBER FIVE DOLLARS A YEAR
(except to charter subscribers)

Entered as second class matter at the Post Office at Concord, N. H., under the Act of March 3, 1879.

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UTILIZING THE GEOGRAPHER

AMERICAN industry has not yet awakened to the need of utilizing the geographer for developing to the best advantage the natural resources of the country. In Great Britain, Japan, and much of the continent of Europe, the geographer is employed as successfully as any other trained expert in developing the resources, converting them into merchantable goods, and finding the best market for them.

The rapid rehabilitation of Germany since the war is in no small measure due to the knowledge and activity of her geographers. They have helped her readjust herself to diminished area, to curtailed resources, and to circumscribed external relations so successfully, that her population, larger than before the war, is living under a standard of living higher now than then, and her industries, almost prostrated by the treaty of Versailles, are wellnigh restored to their former extent, efficiency, and competitive energy in the marts of the world.

In the United States the fundamental knowledge and training of the geographer is needed in the solution of many pressing political and economic problems. He should aid much more frequently than is now the custom, in formulating the programs for an intelligent utilization of the nation's resources, in developing the methods of transportation and marketing, in planning roads, and cities, and ports, and foreign policies. He should be working with the geologist, the biologist, the economist, the farm and mill manager, the banker and the statesman, in maintaining and extending the prestige and influence of United States business, commerce, and politics, the more effectively to serve the people's needs.

The geographer should not be restricted to the classroom. His field for service is unlimited. He is prepared to go to work when the call comes. How long must he wait?

ECONOMIC GEOGRAPHY

VOL. III JANUARY, 1927 No. 1

FISHERIES OF THE NORTH ATLANTIC

J. H. Matthews

Production Manager, Atlantic Coast Fisheries Company

THE extent of the sea is three times as great as the land surface of the earth, but the areas frequented by edible fish—the fishing grounds on which fish are caught—are relatively small, usually confined to the neighborhood of coasts, or to banks in close proximity to them. The region of sea adjoining the Continental land and having a depth of approximately 1,000 fathoms (6,000 feet) may be regarded as the Continental shelf. It is an area of transition between truly Oceanic and truly Continental regions. It may have been sea or land, and undoubtedly it has been the locus of extensive geological changes. Off the coast of northeast America the shelf extends all the way across the North Atlantic Ocean to the northern shores of the Bay of Biscay, and even between Florida and Newfoundland it is wider than the average of that of South America, Asia, and Africa. The Continental shelf is the fishing ground for practically all our pelagic and demersal fishes.

It is quite certain that the Newfoundland fisheries were known to Biscayans and Normans as early as the year 1504. When Cabot discovered our continent, Europe, including England, was Catholic and during the fasts of the Church, the pickled herring of Holland was the principal food. The consumption of fish was immense, and the Dutch, having enjoyed the monopoly of the supply, had become immensely rich. The knowledge communicated by Cabot and the voyagers who followed him, that the waters of America contained, not only an abundance, but many varieties of fish, caused intense excitement on the subject of fishing, throughout Europe.

Before the year 1600 there were 150 French, 100 Spanish, 50 Portuguese, and 200 English vessels fishing regularly on the newly discovered banks. These fisheries were regarded as one of the greatest sources of wealth then known to the world. Colonies were established in connection with the enterprise, and the influence of the great banks upon the early settlement of some portions of our northeastern coast has probably never been estimated at its true value by historians.

International disputes concerning fisheries are merely one phase of a long series of controversies over the freedom of the seas that have disturbed the peace of the world for hundreds of years. That the seas are free and the property of no one was a maxim of Roman law. Most of the disputes concerned the nations of Europe, but as this article is to deal with the fisheries of the Atlantic coast of North America, we will only consider the disputes which concern these fisheries.

In Colonial days, New England fishermen resorted in great numbers to the fishing grounds along the Newfoundland coast, where, of course, they had the same rights as other British subjects. The retention of these rights after the Revolutionary War was secured by the determined efforts of the American commissioners who negotiated the treaty of peace in 1783. John Adams, one of the

treaty makers, declared that New England had "spent more in blood and treasure than all the rest of the British Empire" in securing these rights in the days when they were a bone of contention with France, and that he would not put his hand to any treaty that did not guarantee them. The result of this stand was that for some years after the Revolution, Americans had exactly the same freedom as the British to fish along both the Newfoundland and the Canadian coasts, and also to dry and cure fish on shore at various specified points.

After the War of 1812, Great Britain claimed that these rights were abrogated, because, according to international law, all treaty obligations terminate with a declaration of war. The Americans, on the other hand, contended that the fishing rights were received as a part of the partition of the British Empire in North America. This contention is an interesting example of the fine distinctions with which diplomacy has to deal.

A seemingly harmonious arrangement agreed upon in 1818 merely inaugurated a new era of squabbles lasting more than ninety years. Not only were the United States and Great Britain at odds, but the Colonial authorities in Canada and Newfoundland at times adopted different and mutually antagonistic policies with regard to American fishing rights. To make matters worse, the French had a long standing quarrel with the British about fishing on the so-called "French shore" of Newfoundland, in which Americans became involved. In one case the United States had to pay a large sum of money to offset supposed advantages gained by American over Canadian fishermen.

Finally in 1910, the Newfoundland fishery dispute was submitted to the tribunal of The Hague. Hundreds of documents were presented in evidence, some of them dating back to the seventeenth century. The Court virtually reestablished the treaty of 1818, but cleared up doubtful points, and decided, among other things, that a bay was not to be regarded as a part of the high seas unless it was more than ten miles wide at its mouth.

THE FISHING GROUNDS

The term "fishing ground" is commonly applied to an area in which fishing is carried on, whether the fish are taken at the surface or at the bottom, whether near the coast or at a considerable distance from it. The regions traversed by the mackerel and menhaden, in their periodical migrations, during the spring, summer, and fall, are classed as the mackerel and menhaden grounds, and, in the popular mind, belong in the same category with those well-defined elevations and depressions of the sea bottom which are the constant resort of the cod and halibut and other bottom feeding species. We also speak of the fishing grounds for herring, lobsters, shrimps, oysters, and sponges, although these species are taken near the shores, while the cod and halibut grounds are sometimes distant from them several hundred miles.

THE NORTH ATLANTIC BANKS

The most important grounds, furnishing by far the greatest cod fisheries of the world, are located off the eastern coast of North America between Nantucket and the eastern coast of Newfoundland. These banks form an almost continuous series of broad submarine elevations, stretching a distance of 1,100 geographical miles, and with a varying width of from 50 to 250 miles. The area of the banks total 70,000 square miles.

The Flemish Cap is the outermost of the Great Newfoundland Fishing Banks, and it is also the least perfectly known. It lies between the parallels of 46° 50′ and 48° north latitude, and the meridians 44° 06′ and 45° 25′ west longitude, the greatest length being, therefore, 70 geographical miles and the greatest width 56 miles. About the only vessels that visit the Flemish Cap are those engaged in the salt halibut and cod fishery.

The Grand Bank

This immense fishing ground, which lies southeasterly from Newfoundland, is of about the same size as that British province, and equals in extent all of the other off-shore fishing banks of the eastern coast combined. Its area, within the 60-fathom limit, is about 37,000 square miles. It extends over more than four degrees of latitude from 42° 57′ to 47° 04′ north, and over nearly six degrees of longitude from 48° 06′ to 54° 11′ west, and has an irregular triangular outline, one side facing north-northwest, another southwest and the third about east by south. The northwestern and eastern sides are each about 264 miles long in a straight line, and the southern side about 225 miles long.

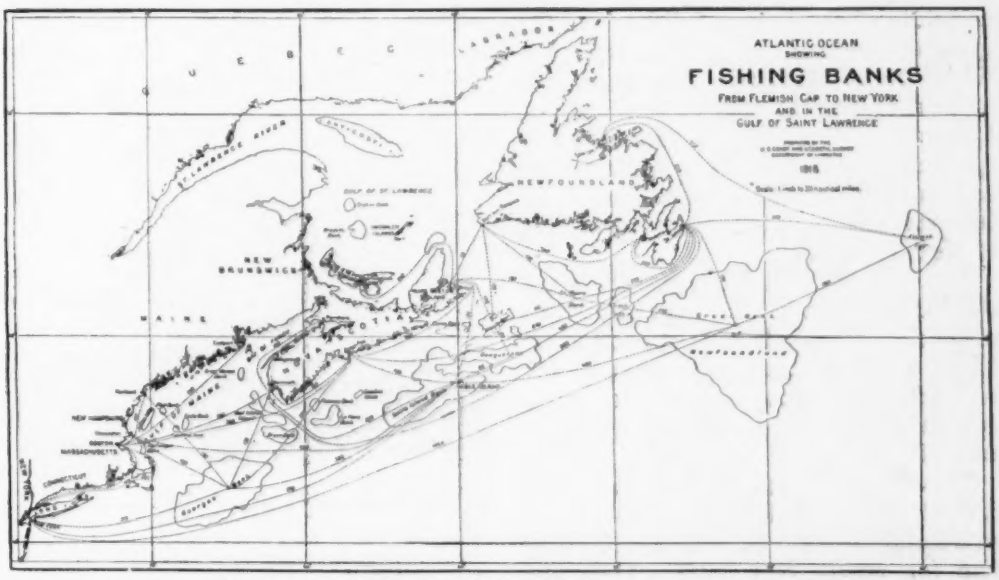


FIGURE 1.—The fishing banks off the coast of New England, Nova Scotia, and Newfoundland are among the most famous and most productive fishing grounds in the world. Fishermen from almost all the countries bordering upon the north Atlantic come to these waters for their annual harvest.

Green Bank

This bank has an irregular, elongate, pear-shaped outline, the longer axis extending due north and south. It is for its size one of the least important of the fishing banks of the western Atlantic, but one of the best halibut grounds lies in the deep water near its southern part. The bank is situated between Grand and Saint Pierre Banks, being seven miles distant from the former and fifteen miles from the latter. Its extreme length within the 60-fathom line, is 62 miles, north and south from 45° 09′ to 46° 11′ north latitude, and its width is 36 miles, between the meridians of 54° 08′ and 54° 58′ west longitude. The area of the bank is about 1,450 square miles.

The Bank of Saint Pierre

Situated off the center of the southern coast of Newfoundland between the parallels of 45° 10′ and 46° 54′ north latitude, and the meridians 55° 16′ and 57° 30′ west longitude, lies the Bank of St. Pierre. It is irregularly oblong in shape, about twice as long as broad, and extends in a northwest and southeast direction. The longest side of the bank, which measures about 125 miles, presents a slight outward curve and faces the southwest. The width of the northwestern end is about 35 miles and that of the southern end 65 miles.

The above-described grounds constitute the Banks of Newfoundland. Although

there are extensive banks in Davis Strait along the western coast of Greenland, they are seldom visited by fishermen on account of the short duration of the fishing season, the possibility of being detained by ice in the passage out, the uncertainty of obtaining a full fare and the great distance of the grounds from the fishing ports. Extensive fishing grounds also exist along the northeastern coast of Labrador. These grounds are only frequented by Newfoundland fishing craft and are not at present as economically important as those to the south and west of Newfoundland.

In the Gulf of St. Lawrence there are several small banks, the most important of which are Bradelle and Orphan banks. Most of these inshore grounds are of rocky formation; on some, the bottom is strewn with large rocks with an admixture of gravel, sand, and mud.

Traveling in a southwesterly direction from the Newfoundland grounds we come to a series of banks that follow the coast line for nearly 800 miles. They are Banquereau, with an area of about 2,800 square miles; Artimon, a very small bank (about 120 square miles); Misaine, 1,700 square miles; Canso, about 425 square miles.

Between Banquereau and Sable Island there is a deep passageway, known as The Gulley, which is an important halibut fishing ground.

Sable Island Bank, or, as it is sometimes called "Western Bank," is one of the most important of the western Atlantic fishing grounds, considered as to size or the abundance of fish. It has an area of 7,000 square miles. There are a group of smaller banks—The Owl, Sambro, LaHave, The Ridges, and Roseway, with areas totaling 3,165 square miles.

Following this group is Brown's Bank, whose area is 2,275 square miles. Southwesterly from Brown's lies Georges Bank, which is by far the most important fishing ground near the coast of the United States. It is only exceeded by the Grand Bank of Newfoundland. Its area is 8,498 square miles. Its position between the Bay of Fundy and the Gulf Stream causes the tides to run more swiftly than on the other banks, and to swirl around instead of passing directly back and forth. They sweep around the compass, from left to right, attaining the greatest velocity when flowing southeast and northwest, and the least velocity when moving southwest and northeast.

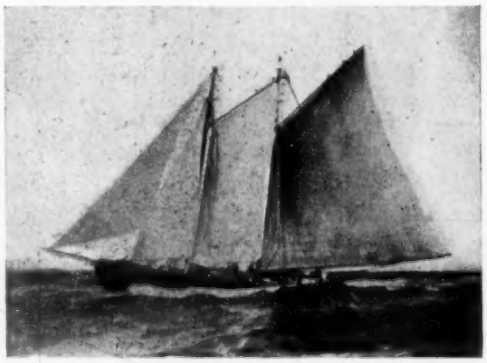


FIGURE 2.—Gloucester schooner bound to Georges Bank. (Courtesy of Fishing Gazette.)

All along the Continental shelf within the 100-fathom curve are numerous rocky ledges, sand and mud patches which are favorite fishing grounds for various species of bottom feeding or demersal fishes.

Between Cape Cod and Cape Hatteras there are no offshore banks, beyond the 100-fathom curve, although the tile fishery, which is conducted about 80 miles off the central New Jersey coast and near the Gulf Stream, is quite extensive. Tile fish have been taken along the edge of the Gulf Stream from off the coast of Long Island to Maryland.

FISHING VESSELS

The European vessels that fished the banks were two- and three-masted, square-rigged fishing smacks, while the Colonial vessels were of several forms, ranging from open boats, built like whale boats—that is, pointed at both stem and stern—to clipper built smacks, with large wells for conveying the fish alive and carrying crews of ten or a dozen men. Today the vessels are of two general types—the two-masted schooner, gener-

ally equipped with auxiliary gas or oil engines, and the steam trawler. Line fishing, either hand-line or trawl-line, is exclusively employed by the schooners. The steam trawler employs a conical-shaped bag which is dragged on the bottom behind the vessel.

HAND-LINE FISHING

Hand-line fishing is carried on from the deck of some vessels, and from the dories of others. These are known as either deck hand-lines or dory hand-lines. Each method is still used in cod fishing, but trawl-line fishermen greatly outnumber those using hand-lines. A dory hand-line vessel usually carries from twelve to fourteen 13-foot dories. When not in use they are nested on the main deck, an equal number on each side. In this kind of fishing one man goes in a dory and operates two or three lines, the number being regulated by the depth of water, strength of tide and other conditions. The lines are usually of tarred cotton, weighing from eight to ten pounds to the dozen, weighted with leads of from 2½ to 3½ pounds each. The depth of water where this method of fishing is employed varies from 15 to 50 fathoms. Bait consists of soft clams, squid, herring, capelin, and other species of fish.

On good fishing ground a skilful fisherman will load his dory in a comparatively short time, and it is not uncommon, when fish are plentiful, for a dory to be loaded three or four times in a day's fishing. It is not unusual for two or three hundred dories to be fishing side by side when the weather is good. While the dories are out the skipper and cook generally fish from the deck of the vessel. Deck hand-line fishing gear is the same as that used by the dories, excepting that the leads are heavier, and the crew fish from the deck.

FIGURE 3.—Dory trawl-line fishing, Grand Bank. (Courtesy of Fishing Gazette.)

Each man's share of the proceeds from the sale of the fish depends upon the number of fish caught by him. The captain keeps a record of all fish caught, and by whom, it having been found that better results follow this system than where all fish are thrown together, and all sharing alike.

Trawl-lines are of two classes, known as "single or double dory fishermen," so called because of one man being required in the single, and two men in the double dories. The dories are 12 and 14 feet long respectively. Each dory is furnished with from four to six tubs of trawl, each tub representing about 500 hooks, seldom exceeding 525 hooks. A barrel sawed off above the lower quarter hoops is used as a tub. The trawls are coiled in the tubs as they are baited, the baited hooks being placed at the side in rows in such manner that they can be thrown out quickly without fouling. A vessel having sixteen dories, each dory having four tubs of trawl, would use 32,000 hooks to a set. The number of tubs to be set is regulated by the abundance of fish, weather conditions, and many other conditions.

The trawl-line consists of two parts, the ground-line and the gangings, together with the buoys, buoy-line, and anchors. The gangings, to which the hooks are attached, are two feet long and are fastened to the ground-line at intervals of 5 feet; although some vessels employ gear with the gangings placed 38 inches apart, and others nearly 6 feet apart.

In setting a trawl two men usually go in a dory, one to throw the trawl and the other to row the boat. Arriving at the place where the set is to be made, the several tubs of trawl are played out, the lines being attached end to end, sometimes reaching a distance of a mile or more.

There are two methods of removing the fish from the trawls, one in hauling the trawl and unhooking the fish as the line is drawn into the dory and coiled in the tub; and the other method, known as "under-running." This method permits the removal of the fish from the hooks and rebaiting them in a single operation, thus saving a considerable amount of labor. Under-running is usually performed on ground where fish are plentiful, and the weather is suitable for such operation. The lines are so arranged that the trawl can be lifted without disturbing the anchors. The object of operating trawls in this manner is to keep them in one position during the time that fish are plentiful.

FIGURE 4.—Steam trawler. Vessels of this type often land 300,000 pounds or more of cod, haddock, halibut, etc., in a single trip. (Courtesy of Fishing Gazette.)

STEAM TRAWLER FISHING

The vessel is a two-masted steel steamer from 115 feet to 150 feet in length, with a beam of from 22 to 24 feet, and a depth of from 11 to 15 feet, equipped with a steam engine of from 450 to 600 indicated horse power. Vessels of this type range in size from 248 to 350 gross tons, and are similar in the character and arrangement of their gear.

The forecastle deck is usually built up and covered in with a turtle back, forming a store room and providing a breakwater which prevents the shipping of water over the bow. The deck is clear from this point, aft to the wheel house, which is situated about mid-ships, over the fire-room. From there a low house runs aft in the center of the vessel, leaving a clear passage on both sides and a considerable space of clear deck at the stern. A low bulwark extends entirely around the vessel.

The trawling winch, which is steam driven, consists of two drums, on which are wound the two wire cables which operate the net. Directly in front of the winch is a hatch leading to the fish hold. Low removable partitions or "checkers" forming a series of pens for the retention of fish, divide the forward deck during the operations of sorting and cleaning.

Fore and aft on each side of the vessel stand the "gallows," inverted U-shaped steel structures which support the sheaves through which the wire cables go outboard.

The bag net of the steam trawlers is about the most important development in fishing gear since ancient times. It was first used in connection with a heavy piece of timber with runners attached at each end to spread the mouth of the bag and permit of towing over uneven ground. The heavy timber, or beam, has been almost entirely superseded by "otter boards" sometimes called "kites" or "doors." These boards are usually about 10 feet long, 4 feet high, and 2½ inches thick, and are heavily shod and reinforced with iron. The trawl is a large flattened conical bag, about 150 feet long, made of strong manilla twine, with a mesh of about 3 inches square in the forward third of the bag. The central third has a mesh of about 1½ inches, and in the last third, or "cod end" the twine is doubled. The end of the cod end is open, and is secured, while fishing, with a draw string. That portion of the mouth of the bag which lies on the sea bottom is secured to a foot line, 140 feet long, reaching from board to board. The upper edge of the mouth is secured to a shorter headline, 110 feet long, also reaching from board to board. In operation, this headline being shorter, causes the top of the mouth of the bag to extend considerably in advance of the

lower portion. The foot line is a wire cable sewed with marline and wound with rope, giving it a diameter of about four inches. The wrapping tends to prevent the line from cutting into the bottom, and thus reduces the wear and tear on the net. Sections of old net or untanned hides are used as chafing gear for further protection.

SETTING THE TRAWL

In setting the trawl, the wire cables are run through fair leads to and through the gallow sheaves, on the side from which it is proposed to set. The cables are then shackled to the chain bridles of the otter boards, which are in turn secured to either wing of the trawl. The cod end is tied up and put overboard, the balance of the net being paid out as the vessel drifts to leeward away from it. A float (usually a balloon-shaped canvas bladder) is secured to the center of the top of the bag. After the trawl has all gone into the water, and the boards have spread the net properly into a position for fishing, the cables are then paid out until the net has reached the bottom, when they are stopped and shackled together near the stern of the vessel.

The trawl is now towed slowly along the bottom at a rate of from two to three miles an hour, usually for about one and a half hours. Then the winches are started, and the net is taken over the side, until the cod end which contains the catch is reached. The throat of the cod end is now folded over and bunched together, a sling is passed around it, to which is attached a fall from the derrick boom on the foremast. A winch now hoists the cod end, with its contents and swings it inboard, where it is lowered over one of the checkers. The draw string is released and the catch falls onto the deck.

If fishing is to continue in the same locality, the trawl is immediately again set as before, and the crew start at once to sort, clean, and stow away the marketable fish and dispose of the trash.

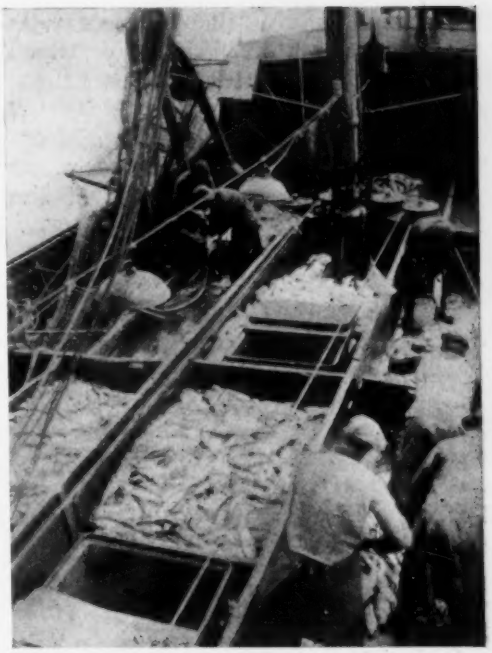


FIGURE 5.—Checkers on the deck of the steam trawler for sorting and washing the fish preparatory to stowing them in the hold. (Courtesy of Fishing Gazette.)

During the year 1925 there was landed in the Maritime Provinces of Canada, 409,805,400 pounds of sea fish caught on the offshore and inshore banks. In addition, the bays and rivers produced 5,486,300 pounds of salmon, 7,372,500 pounds of smelts, 637,200 pounds of shad, 31,456,400 pounds of sardines, 33,743,700 pounds of lobsters, 20,100 pounds of cockles, 208,600 pounds of periwinkles, 21,711 barrels of oysters, 27,690 barrels of clams and quahaugs, and 17,926 barrels of scallops. The total landing value of fishery products of these provinces for the year amounts to $12,600,967.

Newfoundland gathers no official statistics of her offshore fisheries; therefore it is impossible to state accurately the quantity of fish taken by Newfoundland fishermen. However, as there were 1,483,087 quintals of cured cod-fish exported during the fiscal year ending June 30, 1923, it follows that there were more than 300,000,000 pounds caught which went into export trade alone. In addition to the cod fishery Newfoundland exports of herring totaled nearly 85,000

barrels. The total value of exports from the Colony was $20,956,863, of which $12,374,169 represents the value of fresh, cured, and canned fish, and $6,869,159 was the value of cod, seal, and whale oils. Fishery products amount to nearly 92 per cent of the total exports of the Province.

THE GULF OF MAINE

The area of the Gulf of Maine is more than 17,000 square miles, practically all of which is available for fishing of one kind or another. It is nearly rectangular in shape, extending from the coasts of Massachusetts, New Hampshire, and Maine, to a line drawn from Cape Cod to Cape Sable, the distance between these two points being 215 miles. The average breadth at right angles to this line is about 80 miles. The depth of water varies up to 160 fathoms. Scattered throughout the gulf are a number of elevated, gravelly, rocky patches, of greater or less extent, upon which cod and haddock feed in immense numbers. Vessels belonging to the New England fishing fleet, of from fifteen to fifty tons, are the principal visitors to these grounds. Probably in no other area of the same extent, along the entire Atlantic coast, are so many distinct species to be found. 178 species have been recorded as taken in these waters. Most of these are migrants from the colder waters of the north and the warmer waters of the south.

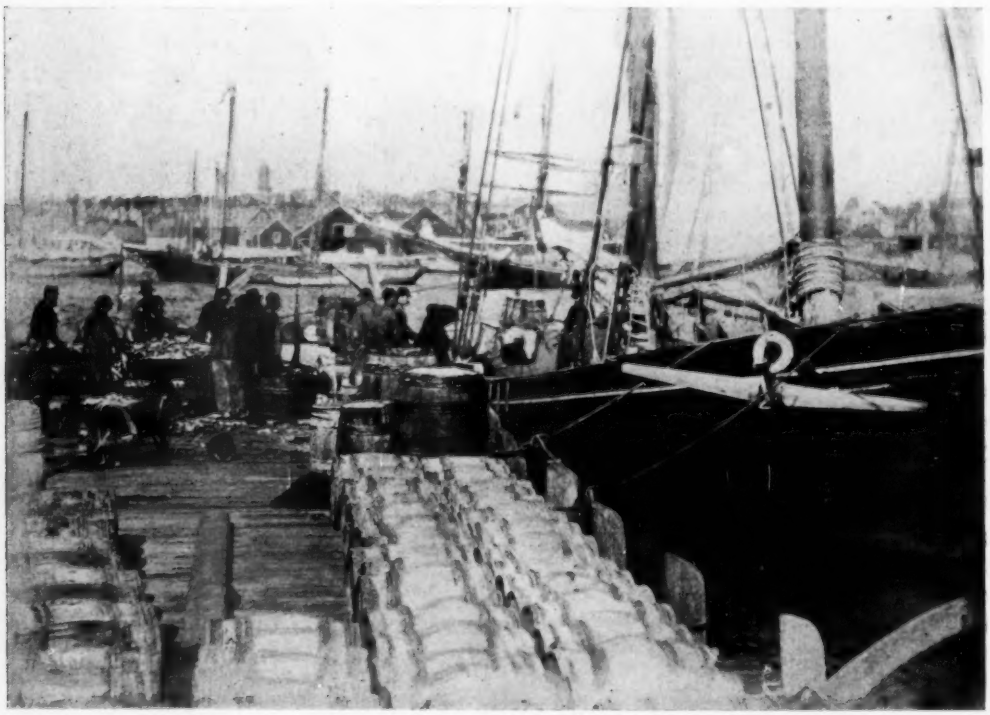


FIGURE 6.—Bank fishermen unloading, dressing, and splitting cod at the wharf. The fish are then salted and stored in the warehouses. On many of the vessels the fish are salted before landing. (Courtesy of U. S. Bureau of Fisheries.)

THE HERRING FISHERY

Herring furnishes one of the most important fisheries of the eastern coast. It is a valuable species, from the young fish, a few inches in length, which supplies the eastern sardine canning industry with its raw material, to the mature herring, vast quantities of which are used in the fresh, salt, and smoked fish trades. Considerable quantities of herring are used as

bait by the hand- and trawl-line fishermen for the capture of cod, haddock, pollock, and other "ground" or demersal fishes.

THE MACKEREL FISHERY

The mackerel fisheries of the Gulf of Maine are the most important in the world. From early June until November this species of fish is more important here than elsewhere along the coast, the schools being distributed over the whole extent of the gulf from the shores outward, irrespective of the depth of water. The large catches are made in the deeper water, where immense purse seines can be freely used.

In the vicinity of Cape Hatteras, these fish make their appearance about April 1, and are sought by a great fleet of vessels, the majority of which hail from the New England states. These vessels are for the most part, the same that fish on the banks for cod, haddock, and halibut, after the mackerel season is ended. The mackerel fishing gear used by these larger schooners consists of a large net, called a purse seine. Most of the fishing is done at night when there is no moonlight. On dark nights the phosphorescence, caused usually by the presence of minute, luminous organisms in the water, shows the presence of mackerel. This phenomenon is called "firing" by the fishermen. A school of mackerel near the surface of the water will show as a glowing patch on the water at some distance. At dusk and dawn, they are also noticeable, since they have a peculiar habit of "sticking their heads out of the water" as the fishermen phrase it. When a mackerel school is located, it is surrounded with the seine, the foot rope drawn, and the fish trapped, or "pursed."

Another method of fishing for mackerel is in the use of the gill net. The vessels engaged in gill net fishing are usually smaller than the Gloucester Bank fishermen, and are known as "netters." The nets are from 25 to 30 fathoms long, and average 3 fathoms deep, and are equipped with a cork or float line at the top, and a lead line at the bottom. The fish are caught by swimming into the meshes of the net which are large enough to permit their heads, but not their bodies, to penetrate. The gill covers of the fish become enmeshed, and they cannot extricate themselves. Net fishing is done on bright moonlight nights and during the day, as moonlight and daylight counteract the phosphorescence in the water and fish will "hit" the net before being aware of its presence.

The mackerel fishing grounds extend from Cape Hatteras on the south to the Gulf of St. Lawrence on the north. During the season, which ends about the middle of October with the fish in Canadian waters, the fishing is most intensively prosecuted.

VESSEL FISHERIES

Vessels furnish a large part of several other varieties of fish with which our markets are supplied. In addition to those already mentioned, the flounder, bluefish, weakfish, scup or porgie, tilefish, seabass, menhaden, and several other species support important vessel fisheries, of which the most important from the standpoint of tonnage landed is that of the menhaden. This fish is of great commercial importance, although sparingly used as food for man. It is one of the most abundant of all ocean fishes, and its range extends along the entire Atlantic and Gulf coasts. The products manufactured from this fish are oil, fertilizer, and fish meal.

NETS AND TRAPS

Inclosures formed by fences of wooden stakes and intertwined with branches, placed at advantageous places in stream, lake, or sea, have long been employed in the fisheries. The openings of such traps are so placed that the natural course of the fish leads into the trap, and once in, it is difficult for them to find the exit. In many cases a long fence (leader) extending from the shore to the mouth of the trap, serves as an additional aid in deflecting the fish into the enclosure. As there are innumerable variations in the

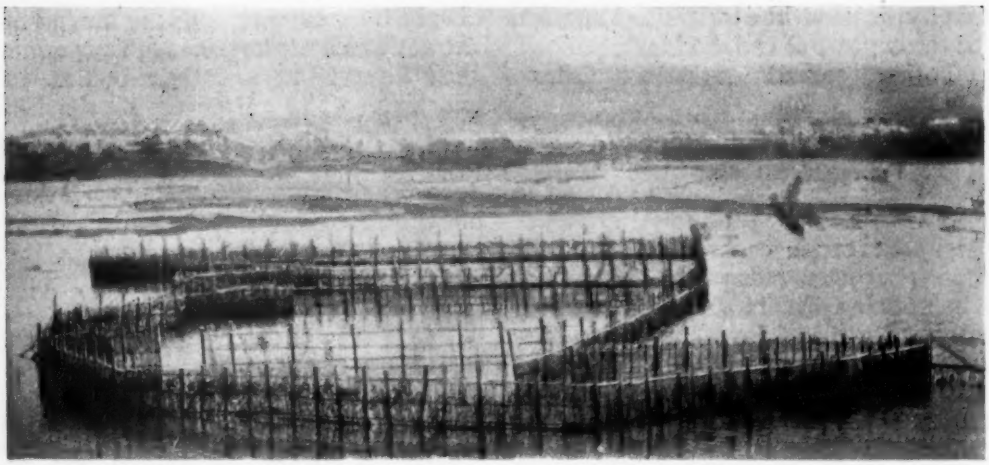


FIGURE 7.—Herring weir at Bar Harbor, Maine. Weirs of this type are common all along the coast of Maine. They furnish a large part of the sardine-herring used in the eastern canneries. (Courtesy of U. S. Bureau of Fisheries.)

form and construction of these traps in use in American fisheries, only a few of the more typical will be referred to. Of these the weirs are the most primitive, and will be described first.

Weirs

Weirs of brush, "brush weirs," are extensively used in the sardine-herring fisheries of Maine. The weirs are usually located at a point of land that extends out into the water for some distance, or in channels, frequently between islands or ledges, where the tide is strong, to take advantage of the tendency of the herring to remain in the strong current. The main body of the weir is a large circular or heart-shaped enclosure formed by driving posts, and smaller stakes in between, into the channel bottom. These smaller posts are usually fastened together by stringers, fastened to the tops of the larger posts. Fine brush is then interwoven between the small posts, completing the enclosure. In some of the newer weirs, netting or webbing replaces the branches. A lead of brush extending from the shore to the mouth of the trap guides the fish into the weir. In fishing the weir, a net is dropped over the mouth of the trap, and the fish are captured with a small purse seine, the fish then being bailed into dories for transfer to the larger boats.

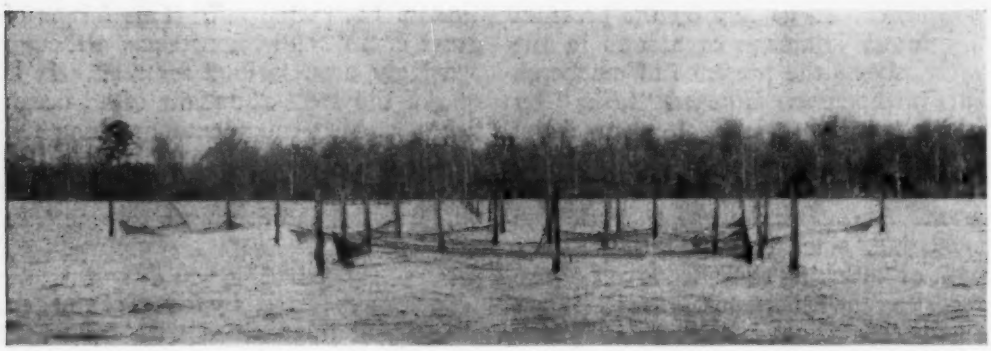


FIGURE 8.—Double-heart pound net. Pounds are common in all the bays, sounds, and in many of the rivers along the Atlantic coast, as well as in the open sea. (Courtesy of U. S. Bureau of Fisheries.)

Pound Nets or Traps

The principle employed in the construction of pounds is similar throughout the entire length of the coast, but the types range from the small inshore, single heart trap costing less than a hundred dollars, to the very large elaborate pounds, set in ten to fifteen fathoms of water, and costing many thousands of dollars. In its simplest form the pound net consists of three parts, the leader, extending from shore or shallow water into deeper water, deflecting the fish into the heart—a heart-shaped enclosure with its apex at the mouth of the trap and its sides extending shoreward and outward from the end of the leader, its ends curved in toward the leader as well as towards the apex, and serves to guide the fish toward the mouth of the trap. The third part of the trap is the "pot" or "crib," usually rectangular in shape, in length from 150 feet to more than 1,000 feet, the size of mesh varying from 6 to 12 inches. In the heart the size of mesh is 3 inches, and in the pot 2½ inches. The bottom of the pot is covered with netting, which can be raised when the trap is fished. The entire pound, including the leader, is supported by poles driven into the bottom, set at intervals to conform to the shape of the heart and pot, and in sufficient numbers to prevent the trap from being carried away by rough seas

Fyke Nets

The fyke net is a long bag distended by a series of hoops, with or without side wings, which serve to deflect the fish into the funnel mouth. The number of hoops varies from two to fifteen, and in diameter from 2 to 6 feet, the first hoop being generally larger than the others. This form of gear is largely used in fresh water

FIGURE 9.—Bunting the fish in a menhaden purse seine. Menhaden represents more than 50 per cent of the production of all fish landed along the Atlantic and Gulf coasts and more than 33⅓ per cent of the fish produced in the entire United States. (Courtesy of U. S. Bureau of Fisheries.)

which the fish are captured. The leader is formed by poles driven down into the bottom, connected with coarse meshed webbing, extending from the bottom to, or slightly above, the surface of the water at high tide. The leader may vary in

fisheries for such species as carp, buffalo fish, catfish, perch, suckers, etc.

Eel Pots

Eel pots are in general use along the Atlantic coast from New York to the

Carolinas. They are mostly made of splints or wire, a few being made of netting, barrel staves, laths, and rattan. The length of the pot ranges from 18 inches to 3 feet. Pots made of splints

FIGURE 10.—Hauling a beach seine. This is one of the most primitive methods of net fishing. (Courtesy of U. S. Bureau of Fisheries.)

are usually about 2 feet long, but those made of other materials are often longer. Some are rectangular in shape, and others cylindrical. Those of splints are round their entire length, but are larger at one end than at the other, with a slight bulge in the middle. The usual type of pot has a funnel in one end from 8 to 15 inches in depth, with an outlet 2 inches in diameter. The back of the wire and net pots, where the eels are removed, is of netting, which is opened and closed by means of a pursing string. Various methods are employed to close the openings of rectangular and splint pots, more or less ingenious. The pots are baited, and are usually set singly, but in some localities they are set in strings of from 10 to 60, and from 15 to 60 feet apart. Bait consists of crabs, shrimp, clams, menhaden, fish heads, etc.

Seines

These nets are long and usually rectangular, the upper edge provided with floats, and the lower edge with sinkers, to keep the netting distended, while the fish are encircled and drawn out on shore or on a landing platform. Generally speaking, seines may be grouped into two classes—first, hawl, drag, or beach seines; and second, purse seines.

The former are usually employed in relatively shallow water, along the shores of rivers and in bays. The net is laid out in water parallel to the shore, the two long hawl lines are used to pull the free ends of the net rapidly to shore, or to landing platforms, on which the net and its catch of fish are landed.

These seines vary in length from the small minnow seine of 5 or 10 yards up to seines of 2,500 yards, or more. The meshes in the webbing will range from ¼ inch bar measure up to 6 inches or more. In some cases the net is rectangular, in others the ends are tapering, the center of the net being much deeper. In some the center is lengthened in a bag or bunt, into which the fish collect and cannot readily escape. This bag or bunt is usually of smaller mesh than the wings. To the end of each wing is attached a brail, which holds apart the cork and lead lines, and to which are attached the hawling lines.

Purse seines are generally used in the deeper waters of gulfs, bays, and the open sea, in the capture of fish which school at or near the surface. When a school of fish is sighted, the seine is laid out around it, and the bottom pursed or shirred together by the purse line, to prevent the fish from settling and thus

escaping. This type of gear is extensively used in the menhaden fishery. These seines vary from 270 to 400 yards in length, and from 18 to 20 yards in depth, with 1¾ inch mesh.

Gill Nets

As the name indicates, fish are caught in gill nets by becoming entangled in the netting, the size of mesh used in a particular fishery permitting the passage of the head of the fish, but not the body; thus the fish is "gilled" and cannot escape. To be effective such nets must be obscure in the water and of sufficient strength to hold the struggling captive, without tearing the net. The nets are usually of fine thread, mostly of linen, although cotton is more generally used than formerly. For fishing they are either anchored or staked, or permitted to drift with the tide or current. They may be so hung as to fish at the surface, at intermediate depths, or at the bottom. They are rectangular in outline and equipped with floats and leads along the upper and bottom hanging lines respectively to keep the net properly distended. In some fisheries it is common practice to tie the nets in series, such series often being of surprising lengths. Character of netting and size of mesh vary with the fishery in which used, the meshes being as small as one inch, up to twelve inches in fishing for sturgeon and sharks.

Trammel nets represent a modification of the gill net. Instead of a single netting there are three parallel lines of webbing, the outside webs being coarse meshed, while the inside web is fine meshed. The fish swims into the outer web, hits the fine web, carrying it through one of the meshes of the coarse webbing on the opposite side, thus forming a pocket from which he cannot readily escape. Trammel nets have an advantage over the regular gill nets in that the fish will remain alive for a much longer time.

MIGRATIONS OF FISHES

Nearly all fishes migrate more or less, some species travelling only short distances, and others going on long "cruises." Migrations appear to depend principally upon three causes or conditions, namely, the development of the breeding organs, the need of food, and the season of the year, or the temperature of the water. Most fishes have customary breeding grounds to which they migrate from year to year to deposit their eggs. The most readily observed example of migrations for the purpose of spawning occurs in the anadromus fishes which mature in the sea, and ascend fresh water streams for the purpose of depositing their spawn. Among the American species of anadromus fishes are the salmon, the shad, alewives, sturgeons, and the striped bass. Some fishes migrate to deeper water for the purpose of spawning, and others go to shallower water. The general movements of the cod is to shallower water during the breeding season, although it probably does not come as close to the shore as was once supposed. On the other hand, the common eel (*Anguilla rostrata*), reverses the migration of the anadromus species, as it leaves the fresh waters and runs out to the deep water of the sea to spawn. Fishes which leave fresh waters and run out to the deep sea for the purpose of spawning are called "catadromus." Many species make no special migration for the purpose of reproduction, but deposit their eggs in suitable places on or near their customary feeding grounds.

Practically all fishes migrate to a certain extent in search of food, but such species as mackerel travel more or less constantly in schools in pursuit of their prey. It can readily be seen that schooling fish have to cover a larger area in search of food than the solitary species, as the supply in any one place must be quickly exhausted when numerous fish, all feeding on the same animals or plants, concentrate there. The solitary species, on the other hand, can usually find foods in one place for a much longer time.

Migrations brought about by the season of the year, or temperature, are so

closely connected with migrations for food that no clear distinctions can be made. It is true that the majority of our shore fishes go to deeper, and therefore warmer water, during cold weather, but such a migration may be only in part for the sake of escaping from low temperatures. Another for seeking the deeper holes is probably for the purpose of finding foods. The menhaden regularly makes long migrations northward during the spring, and southward during the fall. It again is an open question whether these migrations are undertaken for the purpose of remaining in water of a certain temperature, or for the purpose of finding proper food, or for both reasons.

It is not surprising, in view of the large extent of the watery home of marine fishes, that the majority of them wander considerable distances, either along the shores, to and from the deeper water off shore, or, in rare cases, perhaps across oceans. In many cases the direction and the purpose of these movements are very imperfectly understood.

SPAWNING AND REPRODUCTION

All fishes have definite breeding and spawning seasons. The season varies among species, but with the majority of them it occurs during the spring or early summer. Several important commercial species of the Atlantic coast, spawn during the fall or winter, among which are the cod, salmon, menhaden, winter flounder, striped mullet, and spot.

Many fishes have definite spawning grounds which are important feeding grounds for the young fish. Some species migrate toward the shore or into streams to spawn, but a more usual movement perhaps is off shore to deeper waters. The squeteague, for example, enters shallow water in the early spring and remains there until the roe is nearly ripe, when it migrates to deeper waters. Later, the "spent" fish return to reoccupy the feeding grounds in the shallow waters.

Most of the eggs are fertilized at the moment that they are laid, and the parent fishes give them no further attention. In the pipe fishes the eggs are transferred from the female to the male, who fertilizes and carries them in a sort of pouch on the ventral surface of the body until they are hatched. The eggs of the marine catfishes are carried in the mouth of the male fish until they are hatched, and the young fish are protected in the same manner for some time afterward.

In some skates and rays the eggs are fertilized internally, and laid afterward. In some of our brackish and fresh water minnows, Gambusia, Heterandria, and Mollienesia, the eggs are fertilized and hatched internally and the young are born alive.

Fish eggs may roughly be divided into two groups, viz., demersal, and pelagic. Demersal eggs are heavier than the water in which they are spawned, and they are either deposited on the bottom, or they sink after being spawned. The herrings are among the important commercial species which produce demersal eggs. The cod, on the other hand, produce pelagic, or floating eggs. It is obvious that the floating eggs may be widely dispersed by tides, winds, and currents before they are hatched, and the feeding grounds of the young fish, therefore, are much greater in extent than they are among the young hatched from demersal eggs. The young fishes hatched in approximately the same place where the eggs are laid, are more apt to procure the proper foods than those hatched from drifting eggs.

The number of eggs produced varies with the species; the marine catfish appears to spawn not over 55 eggs at one time, while the cod, according to Gunther, may spawn over 9,000,000 eggs during a single season.

GEOGRAPHICAL DISTRIBUTION OF SOME IMPORTANT COMMERCIAL SPECIES

Among the common fishes of the North Atlantic which inhabit shallow

shore waters and live at or near the bottom are several species of flounders, or flat fish, including the winter flounder (*Pseudopleuronectes americanus*), and the sand dab (*Lophopsetta maculata*), ranging northward from the Middle Atlantic states; the summer flounder (*Paralichthys albiguttus*), and the croakers (*Micropogon undulatus*), occur in Chesapeake Bay and southward. The whitings are taken along the New England and Middle Atlantic states, and are known in some localities as "kingfish," "sea mink," and "sea mullet." The whitings are of the species, namely (*Menticirrhus americanus*, *Menticirrhus littorials*, and *Menticirrhus saxatilis*). The Black Drum (*Pogonias cromis*) is found in commercial abundance from the Middle Atlantic states southward. The tautog, also known as blackfish and oyster fish (*Tautoga onitis*), range from Canada to North Carolina. The Sheepshead (*Archosargus probatocephalus*), is a valuable food fish ranging from Massachusetts southward.

Among the commercial species of pelagic, or surface feeding and swimming fishes common to this section of the coast, are several mackerels. The common mackerel (*Scomber scombrus*), which is taken from the Middle Atlantic states northward, is the most important. The Spanish mackerel (*Scomberomorus maculatus*), is of more southerly distribution, but occasionally considerable quantities are taken along the coasts of Virginia and Maryland. The horse mackerel, or tuna (*Thunnus thynnus*), is taken from the Chesapeake Bay northward. These fish reach a large size, sometimes weighing several hundred pounds. The common herring (*Clupea harengus*), occurs principally north of Cape Cod. Another member of the herring family, which is also a surface swimming species, is the menhaden (*Brevoortia tyrannus*). The blue fish (*Pomatomus saltatrix*), and the sword fish (*Xiphias gladius*), also belong to the pelagic species.

A large number of fishes occurring on the Atlantic coast cannot be classified as either surface or bottom feeders. They are found sometimes at the surface and at other times on the bottom. This group included the weak fishes, or squeteagues (*Cynoscion regalis*, and *Cynoscion nebulosus*), the spot (*Leiostomus xanthurus*), the butter fish (*Poronotus triacanthus*, and *Peprius alepidotus*), the scup (*Stenotomus chrysops*), and the mullets (*Mugil cephalus*, and *Mugil curema*).

Among the fishes which live chiefly at some distance from the shore and in rather deep water, the following species may be mentioned: the cod (*Gadus callarias*), the haddock (*Melanogrammus æglefinus*), the hakes (*Urophycis tenuis*, and *Urophycis chuss*), the silver hake (*Merluccius bilinearis*), the cusk (*Brosme brosme*), the sea bass or blackfish (*Centropristes striatus*), the halibut (*Hippoglossus hippoglossus*), the tile fish (*Lopholatilus chamaeleonticeps*).

All of these species, with the exception of the sea bass, which ranges from Maine to Florida, are only taken in commercial numbers off the coasts from the Middle Atlantic states northward.

The principal anadromous fishes of the North Atantic coasts consist of, the smelt (*Osmerus mordax*), the alewives (*Pomolobus pseudoharengus*, and *Pomolobus aestvalis*), the shad (*Alosa sapidissima*), the striped bass or rockfish (*Roccus lineatus*), the sturgeon (*Acipenser sturio*). These fish enter all suitable rivers and streams where they support important fisheries. Very few of these species are taken in the open sea.

Mollusks

The mollusks, called "cuttles" or "cuttle fishes," bear a very important relation to the fisheries, and consequently to the food supply of the nation. The giant cuttle fishes of the north (Architenthis), and the common squids and Colamaries of our Atlantic coast belong to the ten-armed division of the order termed Decapods.

The common squid is taken in consid-

erable quantities from Cape Hatteras to Cape Cod, and is used to a large extent for bait. It is known to be a very important element in the food supply of the blue fish, tautog, seabass, striped bass, weakfish, kingfish, and many other of our larger market fishes. Squid, octopods, and a few others of the cuttle fishes are sold in the market as food fishes, principally to those of the Latin races.

Gasteropod mollusks, those bearing a shell in a single piece and usually spirally whorled, are not of commercial importance. They are here mentioned because they furnish a part of the food supply of many important commercial fishes. A few of these gasteropods are of minor importance as food for man. *Buccinum undatum*, commonly known as the Cape Ann "periwinkle," is found from Cape Cod to the Arctic. It is the "whelk" or "wilk" of England and Scotland. Two of the largest mollusks of this order on the Atlantic coast are the *Fulgur carica* and *Sycotypus canaliculata*. North of New Jersey these two are confused under the general names of "periwinkle," "winkle," or "wrinkle." The former of these extends northward only to Cape Cod, while the second is of more frequent occurrence along the Connecticut shore and Vineyard Sound. They do great damage to the oyster beds, and are very properly destroyed by fishermen whenever a chance occurs. On the coasts of New Jersey and southward where Fulgur reaches an immense size, and is known as the "conch" the oystermen complain very little of any damage done by it.

The shells of both of these mollusks were used by the Indians of the coast ceremonially, and as material for the making of white wampum, their money of inferior value, the bead-shaped sections of the central column of the shell being used for this purpose. From them, also, were fashioned sundry articles of service and ornament, such as trowels, spoons, and dippers; they are sometimes even yet called "ladle shells."

The razor-shell (*Ensatella americana*) is frequently used for food in New England. It passes under the various names of "razor fish," "razor clam," "knife handle," etc. It burrows into the sand where it may be dug out with a clam rake or spade.

The "soft clam," "long clam" or "nanninose" (*Mya arenaria*) is dear to New Englanders, and only less numerous than the hard clams in the markets of New York and Philadelphia. This clam lives just beneath the surface of the

FIGURE 11.—Digging clams. When the tide ebbs, leaving the mud flats bare, thousands of men and boys may be seen digging the soft clam with rake, hoe, or shovel. (Courtesy of U. S. Bureau of Fisheries.)

sand and mud above low water mark, and is easily secured with a hand shovel. A large number of persons, chiefly north of New York, derive their living wholly, or in part, by digging it and shipping to city markets. On the northern coasts of New England immense quantities of this bivalve are collected and salted for use as bait in the cod fishery.

Following this comes the quahaug (*Venus mercenaria*), which is known in the markets as "hard clam," "round clam," or in New York, simply "clam." The clams of New York markets are graded into several sizes to meet the demand for various purposes. The smallest sizes, those about one inch in diameter are termed "peanuts"; the next larger size are "little necks," these range from one to two inches in diameter; following these are the "cherry stones" which are about three inches. All these sizes are used for serving raw on the half-shell. The larger sizes, "medium" and "chowders," are used for cooking purposes and range in size from three to five inches across the shell. From Cape Cod to Florida these clams are very abundant, but must be gathered by raking or tonging, since they do not burrow in the shore-sands like the soft clam. A commerce still larger than in the case of the soft clams is carried on with this species as bait and also for food, in which respect it ranks next to the oyster in the United States.

The common black mussel (*Mytilus edulis*) is circumpolar in its distribution, and is excessively numerous at all rocky points suitable for its growth. There are two other species found along the northern Atlantic, *Modiola plicatula* and *Modiola modiolus*, which are sometimes eaten, but are not considered as good as the *Mytilus edulis*. On the coasts of New Jersey and Long Island incredible quantities are gathered from the banks at the inlets through the outer beaches where they grow, and are spread upon seashore farms as fertilizer.

Another important commercial bivalve is the scallop, fisheries for which flourish in Long Island Sound, Narragansett Bay, and elsewhere. Large fleets of vessels are engaged during the fall and winter months in dredging for these shell fish. The powerful central muscle by which the animal opens and closes its shell forms the edible portion, the rest being discarded.

FIGURE 12.—At one of the large oyster shucking plants at Norwalk, Connecticut, there is always a great pile of oyster shells. The shells are used in the manufacture of poultry grit. (Courtesy of U. S. Bureau of Fisheries.)

There are two species of scallop, *Pecten irradians* and *Pecten tenuicostatus*. The former are found in the warmer waters of bays south of Cape Cod, its shell attaining a maximum diameter of about three and one-half inches. It is marked by radiating grooves, and in young individuals often variously and beautifully colored. This form is much the most common in our markets, where they are known as "bay scallops." The later species inhabit the colder offshore waters, and when full grown possess a shell about seven inches in diameter, without radiating grooves or pigment. The market term for these larger species is "sea" scallops. Bay scallops are considerably more expensive in the wholesale markets than the sea scallops.

The oyster is undoubtedly the most important mollusk to be found along the shores of the United States. Its history is a most interesting subject to pursue, but space permits only a brief account of the industry. The early settlers found oysters in great abundance all along the shore southward from Cape Cod. Natural beds were present in

many parts of Buzzards and Narragansett bays, and almost everywhere on the coast of Connecticut. On both shores of Long Island, and all about Manhattan Island and extending up the Hudson as far as Ossining oysters were in great abundance. From New Jersey to Chesapeake Bay the natural oyster growth was so extensive that it was long before there was any anxiety about its depletion. From the time the country was first settled, however, there was a steady decline, and early in the nineteenth century this decline began to attract attention.

In the year 1855 a few East River oystermen began to spread clean shells on some of the unproductive bottoms near City Island, under the protection of a very wise law, passed in that year, which gave them the right to occupy and control certain definite tracts of river bottom. Multitudes of young oysters settled on these shells, and were transplanted and cared for until they became large enough to be marketed. In this way there arose the method of cultivating oysters that is practiced to this day, all along the middle Atlantic and southern New England coasts. The natural beds or reefs of the north now amount to little, except for "seed" that they produce. There are still enormous oyster reefs in the south Atlantic, but they cannot last. Where there is such great abundance, it seems difficult to believe that it is not inexhaustible. Though it must disappear, its place will undoubtedly be taken before that event, by a better and much larger supply such as now exists in the north.

Crustaceans

The oyster crab (*Pinnotheres ostreum*), is found wherever oysters occur. The female lives, at least when mature, within the shell of the oyster, in the gill cavity, and is well known to most consumers of oysters. The males are seldom seen, and rarely, if ever, in the oyster. This crab has been recorded from the coast of Massachusetts to South Carolina. It is eaten both raw and cooked, either along with the oysters with which it is associated, or as a separate dish. It is also

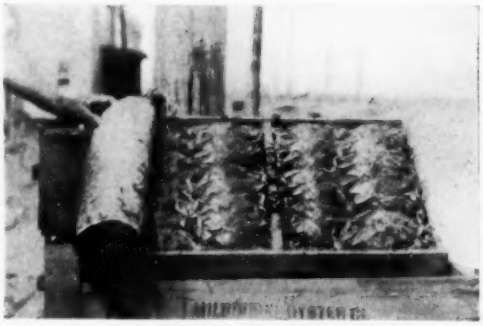


FIGURE 13.—Soft-shell crabs. Crabs are packed in trays, the trays placed one upon another in a box, known to the trade as a trunk. From ten to twenty dozen crabs are thus packed in a trunk for shipment to market. (Courtesy of U. S. Bureau of Fisheries.)

pickled for domestic use and for the trade.

The rock crab (*Cancer irroratus*), is common along the New England coast, where adult specimens occur in all depths of water from low tide level to about twelve fathoms. Smaller specimens, however, have been obtained in from thirty to fifty fathoms of water. Its entire range, so far as has been determined, is from the Straits of Belle Isle, Labrador, to South Carolina. It is most abundant in the Gulf of St. Lawrence, but south of New Jersey it is rare. This crab is not much in demand as an article of food in the markets south of New England. The "Jonah crab" (*Cancer borealis*), the green crab (*Carcinus mænas*), and the "lady crab" (*Platyonichus ocellatus*), are more or less abundant along the coast but are used little as food.

The common edible blue crab (*Callinectes sapidus*), of the eastern coast of the United States, ranges from Cape Cod to the Texas border, and next to the lobster, it is the most important crustacean of our waters from a commercial point of view. This species furnishes our eastern markets with the "soft shell crab," the "hard crab," and the fresh "crab meat." The center of the crab industry is at Crisfield, Maryland, where large packing houses are located, and where there are excellent railroad facilities to transport shipments to the larger cities of the east and middle west. The Chesapeake Bay, and the several rivers of Maryland and Virginia

flowing into the bay, form probably the greatest crab producing area along the entire Atlantic coast.

The lobster (*Homarus americanus*), ranges along the Atlantic coast from Labrador to Delaware. It is more abundant along the Canadian and New England coasts than that of the Middle Atlantic states, although at certain seasons considerable quantities are taken in the waters off the Long Island and New Jersey shores. Lobsters do not generally begin to spawn until they have attained a length of about ten to eleven inches (exclusive of claws) which is about the legal size of marketable lobsters. Occasionally spawning lobsters have been taken as small as eight and nine inches, but such as these are very rare. Like many other crustaceans, the lobster carries a very large amount of spawn on the exterior of the body at each spawning time. The number varies with the age and size of the lobster, but to what extent is not known. It has been said that a two-and-one-half pound lobster will bear externally an average of twenty thousand eggs at one spawning.

PRODUCTION STATISTICS

The Federal Government does not have jurisdiction over the fisheries, except in the territory of Alaska. Each state makes its own laws for the protection and conservation of the fishes within its boundaries, and in marine districts within one league of its shores. The coastal states issue licenses to residents to place nets and traps in the territorial waters at certain specified places. The licensee must then procure a permit from the Engineers Division of the United States War Department and conform to the regulations of that department, which require, among other things, that lights be affixed to the poles of traps at night, to prevent them from becoming a menace to navigation.

Many of the states require the trap fishermen to report each year, the quantities of each variety of fish taken during the year, but as there are no uniform state regulations regarding this requirement, the Federal Bureau of Fisheries makes periodical surveys in each section of the country and gathers statistical data from the records of fishermen and other reliable sources. At Boston, and Gloucester, Mass., and Portland, Maine, representatives of the bureau secure accurate information concerning the vessel landings at these ports. These data are published each month as an official bulletin of the bureau, and constitute a source of information upon which to base rather reliable conclusions regarding the industry throughout the region reported. Such data are highly desirable from the whole coast.

A survey was made of the New England fisheries for the year 1919 and of the Middle Atlantic states for the fiscal years 1920–1921, which showed the following results:

FISHERIES OF THE NORTH ATLANTIC STATES

Items	*New England* 1919		*Middle Atlantic* 1920–1921	
	Number	Value	Number	Value
Persons engaged	30,767		55,244	
Vessels, fishing	757	$8,501,081	1,227	$8,634,632
Tonnage	24,099		20,101	
Outfit		2,400,500		1,481,629
Vessels, transporting	221	741,005	671	1,305,375
Tonnage	3,214		11,465	
Outfit		185,425		216,401
Boats	10,364	2,280,713	20,506	3,577,246
Seines, Gill nets, Trap nets	17,596	1,880,210	39,858	2,747,714
Eel, Lobster, and Crab traps	243,977	610,878	38,397	66,790
Crab dredges and scrapes			2,042	14,366
Lines		287,579		34,228
Dredges, Tongs, Rakes, Etc.	7,716	47,955	18,858	182,002
Other apparatus		52,710		13,282
Shore and accessory property		20,354,089		17,107,220
Cash capital		3,245,952		3,348,555
		$40,597,097		$38,774,431

FISHERIES OF THE NORTH ATLANTIC STATES

(*continued*)

Items	*New England* 1919		*Middle Atlantic* 1920–1921	
Fish	Pounds	Value	Pounds	Value
Alewives	3,782,289	$121,700	24,896,449	$466,531
Bluefish	34,145	4,354	3,580,337	612,021
Bonita	310,701	29,759	1,989,095	137,539
Butterfish	1,107,246	71,636	7,387,436	384,597
Carp, German	40,141	4,922	1,460,874	175,023
Catfish and Bullheads	1,492	100	1,479,610	93,150
Codfish	84,917,535	3,597,891	1,355,137	75,136
Croaker			23,128,731	725,981
Cusk	2,633,521	89,566		
Eels	1,018,998	112,679	1,082,679	122,215
Flounders	15,541,047	672,846	7,092,479	456,599
Haddock	89,405,609	2,544,617	24,815	1,214
Hake	20,222,267	487,343	856,924	26,993
Halibut	1,960,030	343,213		
Herring, Sea	97,798,886	596,014	179,307	4,670
Mackerel	15,846,373	1,563,950	937,138	149,385
Menhaden	28,433,783	364,243	594,321,817	3,465,204
Perch, white	11,243	1,622	1,171,838	106,920
Pollock	25,009,630	593,122	88,840	2,452
Salmon	20,680	7,938		
Scup and Porgies	8,341,744	823,714	5,692,047	288,428
Sea Bass	70,663	8,131	1,723,969	125,621
Shad	939,995	119,339	9,551,038	1,594,057
Spot			1,579,960	90,257
Squeteagues	382,713	37,994	29,889,313	1,945,485
Striped Bass	40,078	6,639	1,589,630	303,932
Swordfish	1,325,980	294,827	44,865	9,125
Whiting	16,199,637	169,856	4,231,850	76,817
Other fish	3,541,700	225,927	5,835,086	461,278
	418,938,126	$12,893,942	731,171,264	$11,900,630

OTHER PRODUCTS

Items	*New England*		*Middle Atlantic*	
	Pounds	Value	Pounds	Value
Crabs	1,870,132	$54,861	23,323,824	$1,342,742
King Crabs			3,943,924	12,317
Lobsters	10,666,707	2,550,980	1,445,636	287,950
Clams, hard	1,082,152	362,328	2,085,992	823,586
Clams, razor	23,300	3,500		
Clams, soft	4,992,874	475,618	331,650	53,645
Cockles, winkles, etc.	587,900	5,525		
Oysters, market	11,999,715	2,015,798	77,696,612	8,673, 107
Oysters, seed	7,337,659	601,222	18,694,249	963,890
Scallops	1,477,392	499,123	1,350,060	244,050
Squid	6,516,125	127,856	816,637	40,012
Miscellaneous products	1,847,788	247,904	2,831,778	65,856
	48,401,744	$6,944,715	132,510,362	$12,507,155

SUMMARY

Capital invested in New England States	$40,597,097
Capital invested in Middle Atlantic States	38,774,431
Total	$78,371,528

	Pounds	Value
Fish produced in New England States	418,938,126	$12,893,942
Fish produced in Middle Atlantic States	731,171,264	11,900,630
Other fishery products, New England States	48,401,744	6,944,715
Other fishery products, Middle Atlantic States	132,510,362	12,507,155
	1,331,021,496	$44,246,442

FIGURE 14.—Scrape boats. These boats are employed in the crab industry to transport the crabs from the traps to the packing houses. (Courtesy of U. S. Bureau of Fisheries.)

MARKETING

Fulton Fish Market in New York City occupies the foremost position among the wholesale fish markets of the United States. A survey, made for the United States Bureau of Fisheries by the author in collaboration with an agent of the bureau, disclosed that there were 87 wholesale establishments engaged in handling 394,000,000 pounds, or more than 19,000 carloads, of fresh and frozen fishery products of 106 varieties, with a wholesale value of approximately $30,000,000.

The bulk of the salt-water fish received at the market is taken on the off shore banks and in the shore fisheries of the Atlantic seaboard from Newfoundland to Key West. Large quantities come from the waters of the North Pacific, and smaller quantities from the waters of the Gulf of Mexico and California.

Long Island supplies most of the oysters; the bulk of the clams come from points along the Atlantic coast; shrimp are sent from the South Atlantic coast and the Gulf of Mexico; and scallops are shipped in from waters adjacent to Massachusetts, Long Island, and North Carolina.

The Great Lakes, the Canadian lakes, the Mississippi River and its tributaries contribute the greater part of the freshwater fish sold in New York.

During the year 1924, vessels landed approximately 50,000,000 pounds of fish directly at the market wharves; shipments received by express, freight and motor truck aggregated 344,000,000 pounds. About 79 per cent of the fishery products received in the market are consumed in the metropolitan area, the

FIGURE 15.—Fulton Fish Market, New York. The greatest wholesale fish market in the United States, where nearly 400,000,000 pounds of fish are handled annually.

TABLE NO. I.

Distances from principal fishing ports to principal fishing banks in geographical miles

Ports	*Banks*			
	Grand	Banquereau	Sable Island	Georges
St. John's, Newfoundland	180	...	...	...
Canso, Nova Scotia	465	113	88	360
Halifax, Nova Scotia	565	225	165	270
Lunenburg, Nova Scotia	607	244	177	231
Lockport, Nova Scotia	653	280	213	165
Portland, Me.	884	508	438	185
Gloucester, Mass.	913	540	455	165
Boston, Mass.	928	555	470	172
New York, N. Y.	1060	760	650	315

balance being reshipped to points principally within 200 miles of New York City.

The fish pier in Boston is the second largest wholesale market in the country, but it ranks first as a landing port for fishing vessels. During the year 1925 its vessel landings amounted to nearly 150,000,000 pounds, surpassed only by that taken at Grimsby, England. In addition to its vessel landings, Boston receives from various production points about 60,000,000 pounds of fish annually. The principal species sold in this market are cod, haddock, halibut, mackerel, swordfish, and lobsters. On the basis of quantity sale these six species constitute approximately 80 per cent of the total amount of all fresh fish sold in the city.

There are 108 firms conducting a wholesale business in fish and fishery products; of these, 81 handle shell fish, 59 handle smoked fish, and 3 specialize in freshwater fish.

Distribution is largely confined to Massachusetts, and the neighboring states of Connecticut, Pennsylvania, and New York. This group receives approximately 90 per cent of the total quantity handled. New York is Boston's greatest customer, as about 15 per cent of the distribution goes to that city.

Other important wholesale distributing centers from which the country receives a large part of its seafood supply are Gloucester, Mass.; Portland, Me.; Providence, R. I.; Philadelphia, Pa., and Baltimore, Md.

TABLE NO. II

The following statistics, obtained from the U. S. Bureau of Fisheries, are of the vessel landings of fish at Boston and Gloucester, Mass., and Portland, Me., during the year 1925. The fish were caught on the various banks and in the inshore waters from Cape Cod to the Gulf of St. Lawrence. The quantity of each variety is shown in pounds.

Port	*Cod*	*Haddock*	*Hake*	*Pollock*	*Cusk*	*Halibut*	*Mackerel*	*Miscellaneous*	*Total*
Boston	36,215,027	74,281,252	4,646,341	2,759,539	1,899,147	2,837,875	18,386,623	8,012,694	149,038,498
Gloucester	26,628,761	9,581,435	319,695	1,822,791	729,315	111,008	7,026,480	3,252,458	49,471,943
Portland	4,406,342	8,023,573	839,684	707,543	1,084,388	612,219	796,757	1,888,318	18,358,824
Totals	67,250,130	91,886,260	5,805,720	5,289,873	3,712,850	3,561,102	26,209,860	13,153,470	216,869,265

	Pounds	*Valued at*
The total quantity of fish landed fresh was	209,016,801	$7,726,782
The total quantity of fish landed salted was	7,852,464	388,788
Total of all fish landed	216,869,265	$8,115,570

There were twenty-one varieties listed under the heading of "miscellaneous," flounders, herring and swordfish being the most important, aggregating 12,107,953 pounds.

THE COMMERCIAL GROWTH OF PERU

Clarence F. Jones
Economic Geographer, Clark University

PERU, for a long time the leading commercial section of South America, now holds fourth place with only six per cent of the trade of the continent. The Republic does not embrace a great empire like Brazil, yet its per capita trade is more than that of Brazil; in 1925 the per capita trade of Peru was about 44 dollars, while that of Brazil was only 28 dollars.

FIGURE 1.—An ocean vessel lying one-half mile off shore at Talara, Peru, in one of the few natural harbors along the whole coast of the country, a distance of 1,400 miles. Owing to the large ocean swell and to the lack of good natural or artificial harbors, ships must anchor a considerable distance off shore and transfer their freight to barges or lighters, a slow and rather expensive means of transfer.

The three sections of the country—the narrow, parched, tropical coastal desert with thirty or more fertile valleys; the wide bleak and rugged Andean mountain and plateau zone; and the hot forested plains of the Montaña—afford contrasted conditions for a variety of commercial products. Yet, the surplus of the agricultural products of the coastal desert is definitely limited, the minerals of the highlands are exhaustible, and the Montaña has not yet swung into the rapid pace of the present commercial world.

Indians and Mestizos constitute fully 85 per cent of the population of the Republic. The Indians produce little that enters the export movement, except as they farm the sugar and cotton estates of the coastal desert, work in the highland mines, or tend the flocks of the extensive *haciendas* of the plateau. Their low wages restrict their buying power. As a result, they purchase few imported goods. Most of the Mestizo population, too, has low purchasing power and small producing capacity. Like the Indians, they do not add materially to the commercial prestige of the Republic.

Primitive transportation facilities still persist in fully 85 per cent of the country. In 1924, only 2,018 miles of railroads were in operation. No railway net exists; most of the railways consist of short

isolated lines of varying gauges connecting an ocean port with the chief towns and plantations of the adjacent fertile irrigated valleys. Only two systems—the Central and the Southern—extend from the coast into the elevated Andean region. Most of the Andean and Montaña regions still depends upon the slow and primitive means of river and pack animal transportation. In the coastal desert no longitudinal railway connects the irrigated lands and no good motor roads transverse the barren stretches between the fertile valleys, so that the ocean highway is utilized even for short distances.

Scattered along the 1,400 miles of coast line are 30 or more ports which handle the trade of the Republic. Only nine major ports handle both imports and exports, but all may ship directly to foreign countries. Only four possess even fair harbors; the remainder have only open roadsteads unprotected from the winds and the ocean swell. As a result steamers usually anchor a mile or more off shore, and discharge or receive cargo and passengers by means of lighters and launches, a slow and rather inefficient means of transfer (Fig. 1). Yet, with all these handicaps, Peru heard the call of the northern world for fertilizers, raw materials, and foodstuffs, and opened the door for those seeking these materials; and in doing this she set the stage for the large inflow of manufactured wares from the great industrial regions of the world.

THE GROWTH OF PERUVIAN TRADE

Few other sections of South America have shown such an evolution of trade as Peru, i.e., radical changes in the commodities making up the export movement. For three centuries during the Spanish exploitation of mines and lands, a stream of gold and silver flowed from the Andes through Lima, the center of the Spanish colonial empire in America, to Spain via Panama and the pirate-infested Caribbean. This wealth from the Andes enriched the mother country, but it benefited Peru little, if any. The whole Spanish colonial system hindered the permanent development of the country and under this system the economic power of the people was small.

While the mining of silver and gold, with some copper, continued to be one of the chief industries during the infant days of the Republic, it suffered a considerable decay owing to the exhaustion of the more accessible and richer deposits, to the unstable political conditions of the times, and to the entrance of other items into the commercial life of the country. Soon after 1826, the exportation of nitrate of soda from Tarapaca began. Salt, wool, and hides also entered the export trade.

Then, after 1840, the revenue from the exportation of guano assumed an important rôle and for almost forty years the whole commercial and economic life of the country revolved around this one source of wealth. Shipments from 1862 to 1873 averaged 467,000 tons per year. The income from guano provided three-fourths of the national income, furnished capital for the development of agricultural lands, and built railroads that put Peru far ahead of other South American countries in this respect.

During the peak years of the guano industry, the exports of Peru rose to 27 million dollars in 1877, just before the great catastrophe in Peruvian Commerce —the disastrous war with Chile (1879–1884). They did not reach that figure again for a quarter of a century, so disastrous was the setback resulting from the ravages of the war, the loss of the valuable nitrate deposits of Tarapaca, the disorganization of the guano industry, the disruption of the transportation systems, the low ebb in the mining industry, and the financial obligations of the country assumed after 1860.

However, out of the entanglement of these difficulties during the last forty years has developed a new commercial Peru. The foreign trade has grown from 12 million dollars in 1887 to about 200 million in 1925—a 16-fold increase.

After the War of the Pacific, the trade increased slowly; it amounted to only 50 million dollars in 1906, twenty years later. A prompt recovery was impossible; Peru was a bankrupt nation. Much of the agricultural, mining, and transportation equipment had been destroyed or had deteriorated from lack of care, settled labor conditions returned slowly, and capital was not available for large-scale development. However, new industries came forth and gradually established a firm commercial foundation, and paved the way for the remarkable trade expansion which took place after 1910 (Fig. 2).

The cultivation of sugar cane, which had assumed some importance in the seventies, again expanded with the investment of foreign capital in plantations. The growing of cotton also became quite important, owing to the extension of simple irrigation works in a number of coastal valleys to the high price paid in foreign markets for the Peruvian *rough* and *semi-rough* varieties (they brought almost twice as much as American cotton), and to the propagation of Egyptian varieties. The exports of sugar and cotton rose steadily placing these commodities among the leading exports.

The old mineral exports, gold and silver, gave way to new ones. Valuable deposits of high-grade copper ore were discovered at Cerro de Pasco, where the silver deposits had been worked for centuries, and copper soon began to play a significant part in the exports; in 1910–1912 copper led with 24 per cent of the total value. While petroleum did not share the spectacular development of copper, its shipments added another export commodity, a product which was to become increasingly important.

The steady development in all the preceding industries set the stage for the great trade expansion of the last fifteen years. This period was marked by a slow growth, from 1910 to 1914, by an unprecedented increase in value in the exports from 1915 to 1920, the marked drop in 1921, and a slow recovery from that sharp period of depression. The increase

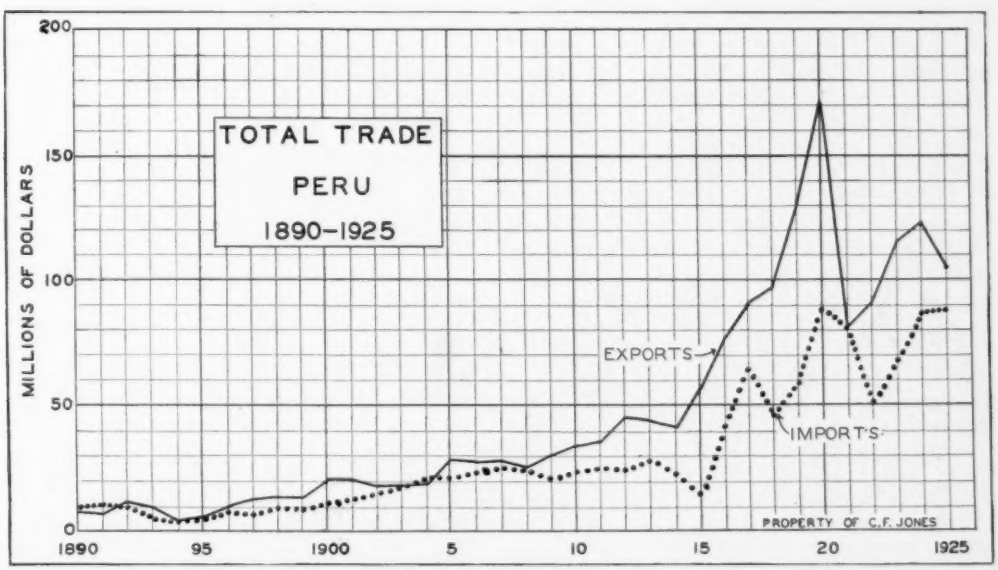


FIGURE 2.—The commerce of Peru increased from about 18 million dollars in 1890 to almost 200 million in 1925, an eleven-fold growth. In this period Peru witnessed a significant growth in the sugar, cotton, copper, and petroleum industries, from which come 90 per cent of the exports. The striking rise during the war and the drop following 1920 resulted chiefly from the high prices obtaining from the exports and not so much to a change in volume movement.

in value of both exports and imports during the second part of this period was due not so much to the volume of movement as to the higher prices obtained for the commodities. Yet, all of the major exports registered a favorable increase. Another factor favoring the growth of trade at this time was the opening of the Panama Canal, which removed, in part, Chile which ships almost entirely the products of the mines, or to Argentina which furnishes only foodstuffs and raw industrial materials from the farms and the ranges. Yet, of the country's annual exports of almost 100 million dollars, four items constitute 90 per cent: sugar 26 per cent, cotton 24 per cent, petroleum products 20 per cent, and copper, with a little

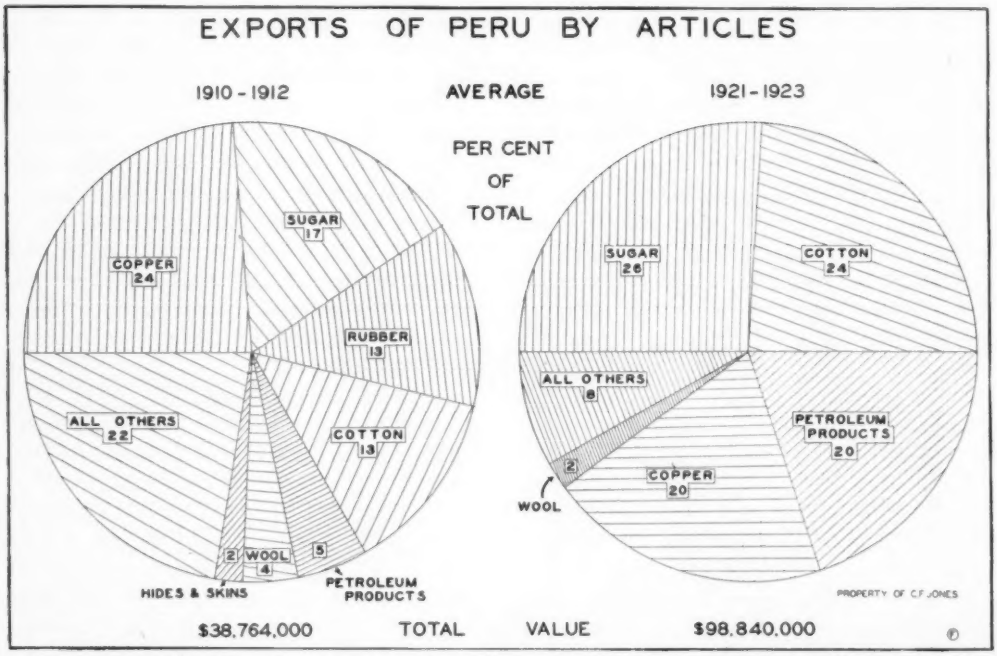


FIGURE 3.—While Peru has a variety of surplus commodities, in contrast to Bolivia which ships minerals almost entirely, and to Brazil which exports chiefly agricultural products, four commodities—sugar, cotton, petroleum products, and copper—make up nine-tenths of the total exports of the country. Thus in a country so long famed for its mineral output, two agricultural products from the coastal desert account for one-half the total exports. Since 1910, a remarkable shift has taken place among the position of the leading export commodities.

the isolation under which Peru had been suffering. Also, the apparent drop in the trade following 1920 resulted largely from the marked fall in prices, for the volume of trade changed but little.

Since the period of depression, the price for the major exports of Peru has been favorable and the volume movement has been strong, for the leading exports have maintained a level much above that of the best pre-war years.

THE EXPORT TRADE

Peru supplies a variety of raw products for the world's markets in contrast to silver, included 20 per cent. Thus in a country known so long for its minerals, more than one-half the exports consist of products of the farm.

A considerable shift in the rank of the different export commodities took place between 1910 and recent years. Sugar has taken the lead from copper; cotton has moved from fourth place to second; petroleum products now rank third, while copper, in the lead in 1910–1912 holds fourth place; and rubber which had third place in 1910–1912 has practically disappeared from the list (Fig. 3).

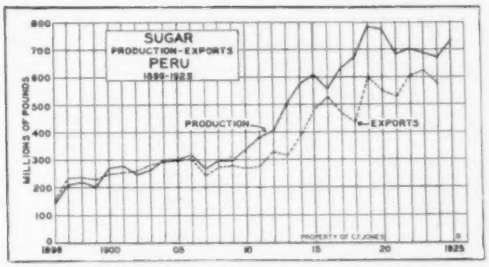


FIGURE 4.—Sugar in Peru is primarily a commercial crop; about three-fourths of the production on the average enters the export movement. It is one of the chief barometers of business in the country. It registered a remarkable growth from 150 million pounds in 1896 to almost 800 million in 1919. The trends since the latter date may indicate that the industry has reached the peak in the restricted area of the irrigated coastal valleys.

SUGAR

One of the most striking features of the Peruvian trade during the last forty years has been the steady rise of sugar from a commodity of little importance to the leading export. The shipments of sugar mounted from 151 million pounds in 1896 to 621 million in 1923 (Fig. 4). The increase in the world consumption of sugar has favored this growth. Also, it has been aided by the introduction of improved methods and machinery, and the construction of irrigation works in the more important valleys of the coastal desert.

Production on a commercial scale is confined almost entirely to fifteen valleys, although several others produce minor quantities (Fig. 5). Here natural factors —the friable sandy loam soil, to which is applied from 150 to 200 pounds of guano per acre per year; the large amount of sunshine; the high temperature throughout the year; and the proper application of water afford optimum conditions for a large production of good quality cane.

In general, the yield of cane ranges from forty to sixty metric tons per acre. In contrast, Hawaiian yields of cane average forty tons, and those of Cuba only twenty. However, it should be remembered that the crop in Cuba is annual, in Hawaii biennial, while in Peru the cane requires eighteen to twenty months to reach maturity.

The absence of rain, the abundance of sunshine, and uniform high temperatures make it possible to plant cane during practically every month of the year if water is available, although the larger areas are laid out during the flood season

FIGURE 5.—Sacks of sugar ready for export on the pier at Salaverry, one of the ports for the Trujillo and Chicama sugar district, the leading sugar section of the country.

from November to April. Three cuttings usually are obtained from one planting, but seven or eight cuttings are common on the better lands. Therefore, only a portion of the fields are planted from year to year. Also, cane can be cut and ground the year round, thus avoiding a rushed harvest season as in other regions, and supplying a rather steady flow of sugar for the export movement throughout the year.

The large estates, some containing 30,000 acres, have made possible the introduction of modern methods and expensive machinery and equipment, factors which play an important part in the commercial production of any crop, for they influence vitally the quality of the product and they reduce materially the waste in the old grinding methods.

In addition, the cane districts of Peru are favored by cheap labor for the average cost of labor on the sugar estates amounts to only one-half the wages in Hawaii or Cuba. Of all the major cane-growing countries, only Java has a lower wage than Peru.

The rate of increase established between 1910 and 1920 in the production and exportation of sugar cannot be maintained. In the valleys actually producing cane, practically all the land for which water exists for irrigation is already under cultivation. Yet, a considerable growth may take place with the introduction of tractors and other machinery which will release land now in pastures and crops for the animals used on the estates for cultivation in sugar, with a more efficient utilization of water, with the introduction of better machinery which will extract a larger percentage of sucrose, and with the opening up of desert lands by new irrigation works now under construction.

The sugar industry, in addition to supplying 26 per cent of all the exports of the country, plays a significant rôle in other ways. It gives employment on a large scale to the uneducated laborer and offers the professional class a wide field of responsible positions. It calls for foreign agricultural implements, mills of elaborate machinery, railway equipment, and many other supplies. In this manner the prosperity of the sugar producers serves as the key to the buying power of a considerable part of the coastal desert population.

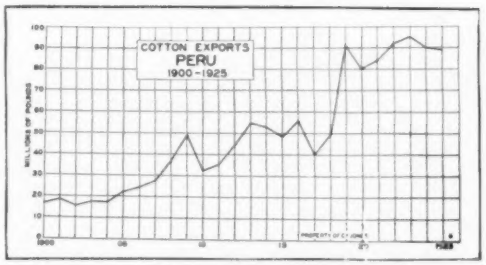


FIGURE 6.—Cotton, like sugar, has advanced rapidly in the trade of Peru during the present century; it has made a five-fold increase in twenty-five years and has become more valuable than the leading mineral products.

COTTON

Cotton, indigenous to Peru, has come forward in a significant commercial way during the last thirty years. The export of cotton increased from ten million pounds in 1896 to ninety million in 1924 (Fig. 6); it now amounts in value to 24 per cent of the total exports of the country, ranking next to sugar, and constituting an important source of revenue for the government by export taxes.

As with sugar, practically the entire cotton crop of Peru comes from the irrigated valleys of the coastal desert, although small quantities are grown in the Department of Loreto on the eastern side of the Andes. Thirty-five valleys are engaged in the production of the commercial crop, but the bulk of it grows in ten small valleys.

While the lack of rainfall restricts the cultivation of cotton to those areas which can be irrigated, the climate in several ways favors the output of a product of rather high quality. No hail injures the growing boll, no rain discolors the ripening fiber, and no frosts arrest the development of the plant. The high temperatures throughout the year and the proper application of water to the heavily fertilized ground afford optimum conditions

for the growth of the plant. Also, while the region is not free from pests and diseases, the dry desert atmosphere hinders their development.

As a result of these favorable conditions, Peru, even with inefficient methods of cultivation and poor machinery, produces high yields of good grade cotton. The average yield of cotton is far above that of the United States and ranks well with that of the other leading cotton countries of the world. Two or three crops are obtained from one planting and in several sections five are possible with a liberal use of fertilizer. While the peak of the harvest extends from April to July, picking takes place in some sections during nearly every month of the year, affording a rather uniform movement of cotton through a long period.

Several varieties, each of which has a number of grades, have a considerable demand in the markets. The "Peruvian full rough" (*aspero*) with a long and very rough crinkly fiber mixes well with wool in textiles. *Mitafifi*, a variety with a long cream-colored silky fiber, is especially suitable for the manufacture of automobile tires. *Tanguis* has a very white and long fiber in both rough and smooth grades and gives yields from 25 to 30 per cent greater than any other variety. It constitutes about 75 per cent of the total Peruvian crop.

Cotton in Peru, like sugar, is primarily an export crop, approximately 90 per cent of the production going to foreign markets. While the exports have registered a remarkable growth in recent years, the increase during the next few years probably will be relatively small. Since the commercial crop comes largely from the irrigated valleys, the immediate extension of the acreage depends upon the development of the irrigation facilities along the coast. At best such extension is restricted; it is estimated at not more than 20 per cent. However, before any significant increase in the exports can take place, improvements in seed selection, cultivation, cleaning, ginning, and grading must be made in order

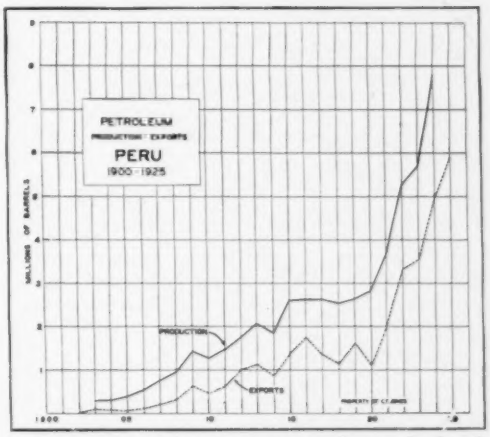


FIGURE 7.—The most spectacular trade development in Peru during the last twenty-five years was the increase in petroleum exports from a few thousand barrels in 1900 to almost 6 million in 1925, giving petroleum products third place in the export movement. Petroleum, like sugar and cotton, is a commercial commodity, for about three-fourths of the production enters foreign markets.

that foreign buyers can get uniform grades of high quality. With the strong return of Egyptian cotton in European markets in recent years, poorly graded Peruvian cottons have suffered from competition. While large areas east of the Andes are adapted to the cultivation of cotton, no large commercial production can take place in that remote region because capital, population, and transportation facilities are far from adequate.

PETROLEUM PRODUCTS

Petroleum products, like sugar and cotton, have come forward in the export trade of Peru replacing gold and silver, the leading products for centuries, and guano which brought Peru to the front in a commercial way during the nineteenth century. Likewise, petroleum contributes its share of the marked increase in Peruvian exports during the first quarter of the twentieth century.

Petroleum production in Peru mounted steadily from a few thousand barrels in 1900 to 2,500,000 barrels in 1915. Then for five years the region barely held the figure reached in the latter year, but in 1920, with greater activity in the

old fields and the coming in of new districts, an increase began which carried the production to almost eight million barrels in 1924 (Fig. 7). Since 75 per cent of the output enters trade, along with the increase in production came a marked rise in the exports, from ten thousand barrels in 1902 to almost six million in 1925. In 1910–1912, petroleum products ranked fifth in the exports of Peru with five per cent or the total, but in 1921–1923 they ranked third and supplied in value 20 per cent of the exports.

The total output of petroleum comes from six fields in the coastal region of northwestern Peru. The quality of the oil ranks good to fair; most of it has a mixed asphalt and paraffin base and yields 20 to 35 per cent gasoline, 16 to 36 per cent kerosene, 20 to 30 per cent naphtha, a small amount of lubricating oils, and large amounts of fuel oil. The crude petroleum and fuel oil assume special significance owing to the general lack of other mineral fuels and water power developments in Western South America. Along the west coast they are being used in larger and larger quantities in locomotives, coastwise vessels, growing factories, and huge nitrate plants of Chile. Crude petroleum and fuel oil in quantity constitute approximately 70 per cent of the total exports of petroleum products.

The part which these products may play in the trade of the country during the next few years is difficult to forecast, for oilfields in general are known for their erratic production. Yet the present fields in Peru are not fully prospected and most of them are young, so that the output probably will increase rather rapidly for some years to come.

The future of oil in Peru, however, does not depend entirely upon the developments in the coastal regions, for possibly the richest of all oil areas in the country lies in the little prospected region of Peru east of the Andes. Here, superficial manifestations in many places and the fact that oil appears on the surface of several rivers lead one to believe that the region may have rich oil deposits. While various investigations have been made during the past few years, nothing has been done except the filing of twenty or more applications for concessions. If oil pools were located, they would have to be developed under the most adverse conditions. The region is highly isolated, being cut off from the West Coast by the broad, high and rugged Andean belt, and separated from the Atlantic by two thousand miles of moist tropical lowland plains. In addition, the region supports a dense tropical forest and holds less than one person per square mile. However, the demand for petroleum products may in the face of all these handicaps, bring possible oilfields of this remote region into productivity.

COPPER

Copper, like all the other important commercial products of present-day Peru, has entered the trade in a significant way only during the last thirty years. With the decline of silver production in the Cerro de Pasco region dur-

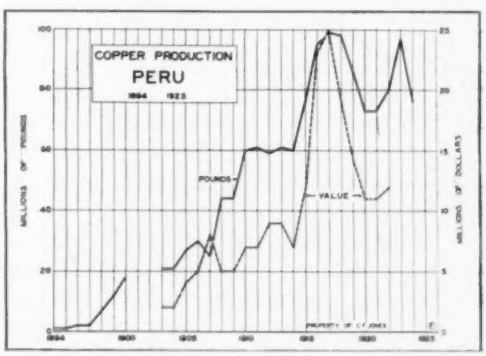


FIGURE 8.—More than ninety per cent of the output of copper in Peru comes from the workings of the Cerro de Pasco Copper Corporation in central Peru; most of the production is exported and goes largely to the United States.

ing the closing years of the nineteenth century, copper came forward to take its place in the very region which it dominated for centuries. The output of copper, most of which is exported, increased from one million pounds in 1894 to ninety-seven million in 1923 (Fig. 8). Before the war (1910–1912) copper led the exports of Peru and constituted in

value 24 per cent of the total; in 1921–1923 it held the fourth place with 20 per cent of the total.

While many rather high-grade copper deposits exist in several parts of Peru, more than 90 per cent of the output comes from the Cerro de Pasco, the Morococha, and the Casapalca mines in central Peru. The growth of the copper industry here has taken place in the face of colossal handicaps of labor, transportation, fuel, and other supplies.

The high elevation of the workings (Cerro de Pasco lies 14,400 feet and Morococha 14,800 feet above the sea) render the operators entirely dependent for heavy labor upon the native Indian inured to working in rarefied air. Managers, foremen, geologists, and engineers must be brought in from the outside on high salaries. They have to go down to sea level once or twice a year to recuperate from the enervating effects of the high altitude. All this increases greatly the overhead expenses in copper production.

The Cerro de Pasco and Morococha deposits lie on the eastern side of the Western range of the Andes. They are reached by the Central Railway of Peru, which crosses the range at 15,680 feet and terminates at Oroya, and private branch lines. To connect the Cerro de Pasco mines with the Central Railway at Oroya, the Cerro de Pasco Copper Corporation constructed a railway for 82 miles across mountain and plateau country. The company also built lines to Morococha and to some coal mines nearby. This development work meant an enormous outlay of capital before production could reach respectable figures. The significance of rail transportation facilities in the mining industry of Peru may be shown by the fact that more than 90 per cent of the total production comes from this region tributary to the Central Railway of Peru and branch lines and that this is the only region adequately served by rail transportation.

FIGURE 9.—The Oroya smelter of the Cerro de Pasco Copper Corporation receives the ore from the Cerro de Pasco, the Morococha, and the Casapalca mines and produces most of the copper of Peru, and one-third of the exports of copper from South America.

Fuel, for the most part, structural timbers, steel, machinery of all kinds, clothing, and even food products, must be brought in from the outside; this can be accomplished in a large way only where adequate transportation facilities exist (Fig. 9). It is under these conditions that the Cerro de Pasco Copper Corporation has come forward as an important copper producer, and to this company Peru largely owes its position as an exporter of copper.

The growth of the copper trade of Peru will depend upon continued development in the old regions and the opening up of new districts. Rather extensive deposits are known to exist in various parts of the Andean highlands of Peru. But before a marked growth can take place, foreign capital in large quantities (The Cerro de Pasco Copper Corporation has invested more than $30,000,000) must be available, transportation facilities must be constructed across barren deserts and over almost unsurmountable

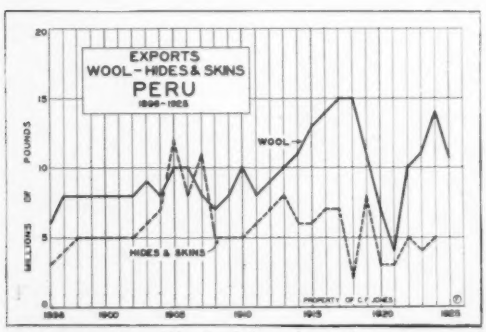


FIGURE 10.—Wool, although a minor export of Peru, has shown a slow growth from 6 million pounds in 1896 to about 15 million in 1916. The marked drop after 1917 resulted from an oversupply of wool in the world's markets and an accompanying fall in the price. Alpaca wool makes up about 60 per cent of the total exports of the Republic. Hides and skins contribute a small part of the trade and show a decrease.

mountain barriers, and concentration mills, smelters, homes for the people, and even hospitals with modern equipment must be provided at the new copper camps. At best all this will evolve only slowly; yet with the continued demand for copper in the world's marts, Peru will continue for some time to produce considerable quantities of copper and to purchase all equipment and supplies required in the industry.

WOOL

While wool supplies only about two per cent of the total exports of Peru at the present time, it is one commodity which has shown a slow but steady growth through the centuries. The exports of wool increased from 6 million pounds in 1896 to 15 million in 1916 (Fig. 10). Peruvian wool comes from alpacas, native only to this highland region, and from rather inferior sheep.

The production of wool is confined almost entirely to the Andean region between 9,000 and 16,000 feet elevation. It constitutes the sole basis of prosperity of considerable sections of highland Peru. Here the low temperature throughout the year favors the growth of a high-quality wool. Also the absence of burr and pronged seed-bearing plants renders the clip free of foreign materials. As a result, the wool compared to that of similar quality grades high; it frequently washes as much as 65 per cent clean wool in England. However, the wool produced under these favorable conditions does not rank high in quality, owing largely to the breeds of sheep and alpacas reared and to the methods of shearing, bailing, and shipping.

The native sheep of highland Peru, direct descendants of merino sheep imported by the Spaniards during colonial times, have degenerated to a marked degree through poor breeding methods. The average flock contains an equal number of black and white sheep, some yellow, and a few light gray ones, which grow only a small amount of low quality commercial wool. As the sheep industry, even on the large *haciendas* of the plateau, is almost entirely in the hands of the Indians, little has been done to improve conditions. Internal parasites which are common and account for about 50 per cent of the losses of sheep, are not understood by the natives. Open-range grazing over most of the *hacienda*

FIGURE 11.—A flock of medium-grade sheep in the Junin plateau of Peru. Most of the sheep of Peru consist of rather inferior native breeds and produce only about 1½ to 2 pounds of wool a year. In some sections they are being improved by the importation of merino rams from Argentina and Chile. The first cross between these rams and native ewes will produce about 3 pounds of wool and the second cross about 5 pounds. The natural conditions of highland Peru are favorable for the production of a good quality wool and with better methods of breeding the product could be improved greatly.

throughout the year does not give the grass a chance to get a start during the summer. As a result, the winter pasturage is very poor.

Alpaca wool, the fine long fiber which is especially adapted to mixing with silk and cotton, constitutes about 60 per cent of the wool exports of Peru. It varies greatly in color, there being eight to ten distinct colors. Like the sheep industry, the alpaca industry is largely in the hands of the Indians who have no system of livestock breeding; all colors or breeds of alpacas and llamas frequently are herded together, giving rise to many cross breeds with varying grades of wool.

While both the sheep and alpaca industries of the Andean region of Peru are capable of considerable expansion, many conditions preclude any marked growth (Fig. 11). The losses of sheep owing to internal parasites, foxes, mountain lions, and condors are very heavy yet nothing is being done by the Indian shepherds to prevent these losses. The pasturage during the winter months is inadequate and of poor quality. As most of the *haciendas* are not fenced, the sheep graze over the whole farm throughout the year, thus preventing the grass from getting a good start during the summer. As long as the industries rest largely in the hands of the Indian shepherd who knows practically nothing about improved methods of breeding, who can neither read nor write, who speaks only an Indian tongue, and who seems content with the wretched conditions of life there, little or nothing can be done to improve these industries. Large land owners wishing to breed up their sheep have to import not only pure-bred stock, but have to bring in shepherds who understand the methods to be employed. Finally, the alpacas and most of the sheep live in high altitudes under climatic conditions which white men will not tolerate except for large and quick financial returns. The sheep and the alpaca industries of this cold highland region offer neither large nor quick financial returns. It appears, therefore, that

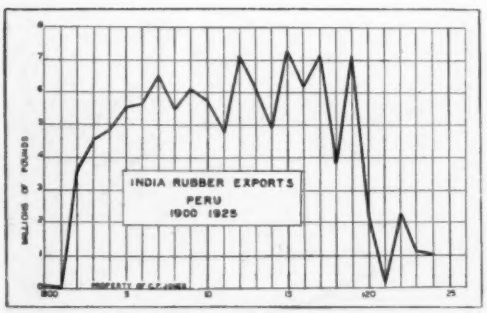


FIGURE 12.—While rubber from the tropical lowland of eastern Peru comprised 13 per cent of the total exports of the country in 1910–1912 (Fig. 3), it has all but disappeared from the export list at the present time. Wild rubber cannot compete with plantation rubber from the Middle East. Since eastern Peru lacks men, capital, and transportation facilities for the development of plantation rubber, it appears that the day of an important rubber trade for Peru is gone.

the wool exports from Peru will increase at best only slowly.

RUBBER

Among the products once prominent in Peruvian exports belongs rubber from the Montaña region of eastern Peru. The rubber industry began in the early eighties, but slow progress was made until 1901. Then the exports increased from a few thousand pounds to 6½ million in 1907. From that year to 1919, the region supplied on the average 6 million pounds per year (Fig. 12).

During this period, the Amazonian port of Iquitos ranked as second port in Peru owing to rubber shipments; the chief business firms of the port accumulated large amounts of capital during the peak years. Gathering wild rubber was carried on along most of the rivers in eastern Peru. Wasteful methods were employed, and the more accessible areas were exhausted.

Since 1919 owing to severe competition in the world's markets from plantation rubber from the Middle East, the production of wild rubber in the forest of Peru has virtually ceased. As in Brazil, wild rubber in Peru cannot be produced profitably at the present price level because of labor shortage, lack of capital, inadequate transportation facilities, and export taxes.

The climatic conditions—relief, soils, drainage, and large area—are as suitable for a plantation rubber industry in eastern Peru as are those of the Middle East. Extensive tracts are the natural habitat of the rubber tree and constitute one of the world's most important sources of wild rubber. However, the small supply of Indian labor in the region; the cost of bringing in labor; and the lack of available capital, exports taxes, and adequate transportation, the key to economic progress in any great industry, will prohibit for years any considerable development of the rubber industry of Eastern Peru.

The leading export commodities play a vital part in the purchasing power of the nation. The state of business in the country as a whole depends directly upon the world prices prevailing for the country's chief raw products. On account of the well-balanced diversity of exports, a depression seldom hits all of them at the same time. Sugar and cotton serve as the chief barometers of prosperity. In southern Peru the wool market is the principal factor in the trade.

THE IMPORT TRADE

While Peru has a population equal to a little more than one-half that of Argentina, its per capita import trade amounts to only one-fifth that of Argentina; the per capita import trade of Peru in 1925 was about twenty dollars, that of Argentina being one hundred dollars. Eighty-five per cent of the population of Peru consists of Indians and Mestigos, who have a high degree of illiteracy and a low standard of living. The Indian constitutes a negative factor in commercial production, except as he labors on the *haciendas* of the coastal desert or works in the mines of the highland. He purchases little from the outside; white man's luxuries do not appeal to him and money appeals only because it will purchase coca and liquor. He is happiest when left entirely alone in his pathetic isolation in the Andean highland and as a

FIGURE 13.—The highland Indian of Peru constitutes a negative factor in the commercial life of the country for he produces little that moves to the World marts and purchases little from the outside. The incorporation of the Indian population into the agricultural, industrial, and commercial activities of the country in a large way is the most provoking problem of present day Peru. A group of highland Indians at Junin on the Cerro de Pasco Railway.

result is not incorporated into the commercial life of the nation (Fig. 13).

In Peru, as in Argentina and Brazil, the exports consist almost entirely of raw commodities, while the imports are made up largely of manufactured wares from the leading industrial nations of the world. Manufacturing in the Republic on the whole is little developed. The lack of domestic capital for investment in industrial enterprises, the natural disinclination of Peruvians to assume risks incident to new enterprises, the scarcity of experienced technical laborers, the lack of adequate transportation facilities, and the uncertainty concerning taxation measures on prosperous industries hinder manufacturing developments and force the country to depend upon foreign sources for its major requirements in iron and steel goods, flour, textiles, wood products, and paints.

IRON AND STEEL PRODUCTS

Although Peru has some high-grade coal deposits and considerable iron ore, they lie in almost inaccessible parts of the Andean highland separated from each other by rugged snow-capped mountains; as a result the iron and steel industry as such is non-existent in Peru. Thus the country imports a great variety of this class of goods. They include almost everything from small hardware and tools to the huge drilling machines for the oilfields, the massive generators, crushers, boilers, and structural steel for the mines of the highland, and locomotives and railway supplies which must move in to keep in motion the flow of the leading export commodities. This class of goods leads in the import trade, supplying 25 per cent of the total.

MACHINERY AND TOOLS

Machinery of a large variety, tools, and vehicles make up 15 per cent of the total imports of the country and three-fifths of the iron and steel receipts (Fig. 14). The more important classes of machinery include industrial machines, engines, and agricultural implements.

Industrial Machinery

This class of machinery represents about 30 per cent of the total machinery

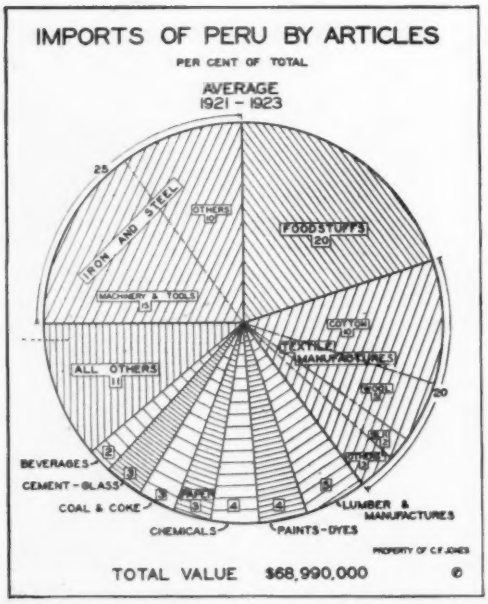


FIGURE 14.—While the exports of Peru consist largely of raw industrial materials and sugar, the imports are made up almost entirely of manufactured wares.

receipts and includes, in the order of importance, mining, smelting, drilling, refining, and textile machines. All but the last group constitute equipment for the production of the major exports of the Republic; they must come forth to continue the flow of commodities which gives commercial stability to the country.

Mining, smelting, and drilling machinery come largely from the United States of America because American interests control the largest copper, silver, vanadium, and oil deposits, and also because of the superiority of American equipment of this nature. Another factor favoring the United States in this trade, in industries where the time element becomes important, is promptness of delivery of machines and repair parts, especially the latter, as transportation from Atlantic and Pacific coast ports of the United States to Peru is much more rapid than shipments from Europe. The markets in this line of goods continues active owing to new developments and greater expansion of existing companies.

With the marked growth of sugar production and exportation has come increased imports of sugar mill machinery, cane carriers, grinders, and centrifugals. They have more than doubled in recent years. Since the Peruvian sugar producers are not as a rule equipped with the most complete and up-to-date machinery, there exists a fertile field here as the sugar industry becomes more stabilized. The better machinery will make it possible for the producers to recover a higher percentage of the sugar than at present; this is necessary if operations are to be extended or even continued, in some cases under present conditions in the world's sugar markets.

The largest manufacturing industry in Peru is the textile industry, yet the demand for cotton and wool spinning and weaving machinery is not large. No new firms have entered the textile manufacturing business during the past ten years and the production capacity of the established plants has not increased greatly in this time. Therefore, the market for these products is restricted largely to replacement equipment. As in other South American countries, The United Kingdom controls the lion's share of this trade.

Internal combustion engines and railway locomotives form a rather important part of the trade in machinery. Only a few new railways are being built so that the receipts of locomotives are largely for replacement. Other engines in use include crude oil, gasoline, kerosene, and alcohol, the first being the most important. These engines are widely used by mining, cotton, and sugar companies, farmers, and builders. Many of the large *haciendas* use these for pumping water and for electric current generation. In many of the cities having municipal water supply, they use them for wells and pumps during frequent interruptions in the public water service.

Agricultural Implements

Agricultural implements do not occupy the prominent place in the machinery trade of Peru that they do in Brazil, not to mention that of Argentina.

Throughout the Andean mountain and plateau region, where almost three-fourths of the population of the country dwell, agricultural implements, in fact even ordinary tools, are little used. While there are many large *haciendas* in this zone, they are devoted almost wholly to animal industries. Where agricultural products are grown, the most primitive methods prevail; the soil is broken by a pointed wooden stick used as a spade or as a plow, crops are planted, tilled, and harvested by hand, and some of them threshed with flails or by driving animals over them on earthen or stone floors (Fig. 15).

FIGURE 15.—The prevalence of crude agricultural methods throughout most of Peru restricts the market for agricultural implements. A threshing scene in the Mantaro valley near Huancayo, Peru; in the middle distance cattle are tramping the straw to separate the grain from the head and in the foreground Indians are winnowing the grain.

In the coastal irrigated valleys where agriculture is dominant, the demand for implements is also restricted. While some of the more up-to-date sugar and cotton estates use machine-driven plows and harrows, the slow steady ox-drawn plow still predominates as in the ages past. Modern cultivators are almost non-existent. The chief handicaps to the introduction of modern implements in the coastal desert include the permanent irrigation ditches which traverse the fields in many directions dividing them into rather small plots; the lack of an educated laboring class, capable of making even an inefficient use of modern machinery; and the availability of a large amount of cheap Indian labor. As long as it remains possible for *hacienda* owners to dispatch their managers to the mountain zone to contract for cheap Indian labor, they will not attempt, at considerable expense, to teach the laborers how to use new implements and machinery. Since a large part of the laboring class consists of this type, it seems improbable that conditions will change in the near future. Therefore, Peru affords one of the least attractive fields in South America for agricultural implements.

Automobiles

Peru constitutes a smaller market for automobiles than some other South American countries, owing to (1) the low purchasing power of most of the population; (2) the lack of even fair roads; (3) the expense of building roads in the rough, sandy, coastal desert, in the rugged Andean region, or in the rainy, forested, eastern lowlands; (4) the high cost of operation because of expensive gasoline (it sells for 40 to 50 cents in Lima) in spite of the fact that the gasoline consumed is manufactured in Peru and because of the social conditions

which demand that the average car owner employ a chauffeur; and (5) the expense of upkeep with the lack of mechanics and the accident risks in the narrow cobblestone paved streets of the average Peruvian town.

coastal desert where most of the cars are used, light cars are preferred as heavy makes find it difficult to traverse the sandy roads sadly in need of repair (Fig. 16). On the narrow rocky roads of the highland only light or medium-

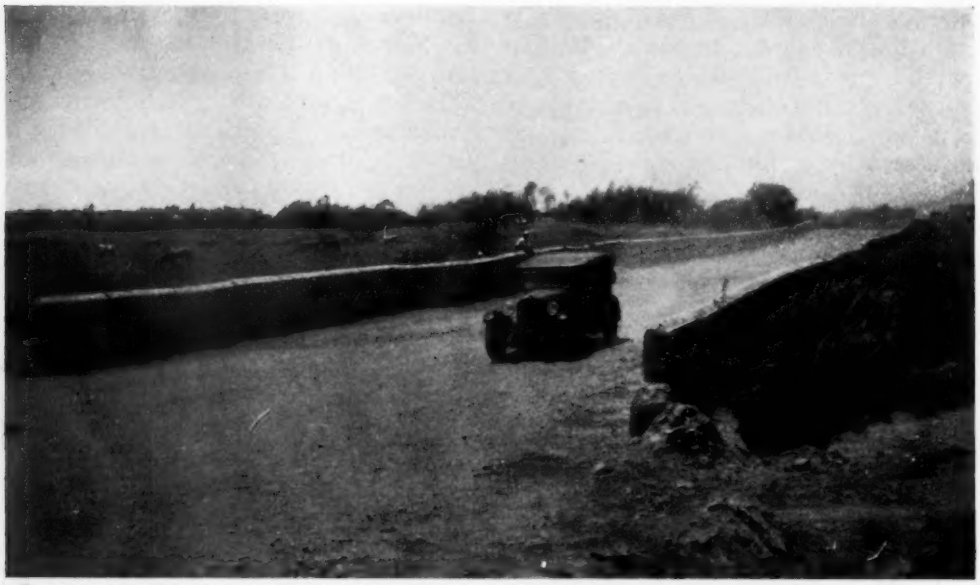


FIGURE 16.—The main highway from Salaverry to Trujillo. On most of the dusty unimproved roads of Peru, cars of light makes are preferred. Travelling over these roads is not comfortable for they usually are full of holes made by heavy carts.

One-half the total number of cars in Peru are in the city of Lima and its suburbs, the one section of the Republic which has even fair motor roads. Even here, it is practically impossible to travel comfortably in any direction for more than 12 miles outside the city. The remainder are used largely in the leading provincial towns of the coastal zone and their irrigated valleys. Only two sections of highland Peru have any cars: Arequipa, in southern Peru, and the towns of Oroya and Tarma, situated on Peru's only transandean motor road, the highway of the Pichis Trail.

While a few expensive cars find a sale in Lima, the Peruvian market demands almost exclusively low and moderately priced cars of four or five American makes; American cars constitute fully 92 per cent of the total imports of automobiles. On the inferior roads of the sized cars can pass the sharp curves and narrow suspension bridges.

The value of automobiles marketed in Peru increased from $28,000 in 1904 to $2,815,000 in 1925. That the imports will continue to mount rapidly is improbable for the Peruvian market, small at best, is now well developed—if not overworked.

OTHER STEEL PRODUCTS

The increased use of re-inforced concrete construction in the cities for large buildings, the installment of city water works, the growth of the petroleum industry, the building of new irrigation dams, enlarged smelters, sugar mills, port facilities, and some new railway lines, have called for considerable amount of structural steel in rods, beams, plates, pipes, and corrugated sheets. As with most other classes of iron and

steel goods, the United States leads in the trade.

In contrast to other South-American countries, especially Argentina, Peru consumes little wire for baling purposes. Cotton and wool from Peru generally are baled with steel hoops or bands. Neither does the Republic use much wire for fencing; mud walls serve almost exclusively as fences on the coastal desert (Fig. 16). In the Andean region, the grazing section of the country, the fences are made of rock or of certain thorny plants grown in rows. However, large sections have no fences, the animals being herded entirely by Indian shepherds.

In comparison with the imports of other iron and steel goods, the consumption of electrical supplies in Peru is small. Peru presents at best a restricted field for electrical goods owing to the low purchasing power of most of the people and their attitude towards modern improvements.

As in the past, the trade in iron and steel goods in Peru will, in the future, continue to remain largely in the hands of the large mining, petroleum, sugar, cotton, and railway companies, organizations engaged in the production of the leading products of Peru for the export movement.

FOODSTUFFS

Foodstuffs rank as the second class of goods marketed in Peru, supplying one-fifth of the total receipts.

In spite of the fact that considerable wheat is grown in Peru, wheat and flour constitute from one-third to one-fourth of the total imports of foodstuffs. About two-thirds of the wheat comes from Argentina and almost all the remainder from Chile and Canada, while the flour is supplied largely by the United States.

Lard, the next foodstuff in importance, is purchased to the amount of one and one-half millions of dollars from the United States. The American product has no competitor in the Peruvian market owing to uniform grades and to lower prices quoted.

Despite the fact that in the coastal desert of Peru rice ranks as one of the leading crops, rice imports each year amount to more than one million dollars, it being the third foodstuff in the order of importance. Rice comes almost entirely from the Orient.

In addition to these leading articles, a great variety of foodstuffs—fruits and vegetables, canned meats, butter, fish, and condensed milk—is received in considerable quantities. A rising standard of living, increasing population, and industrial developments will call for larger imports of articles of food in both quantity and variety, as the possible expansion of agriculture in the coastal desert is restricted by the amount of available land and irrigation water.

TEXTILES

Despite the facts that (1) the making of cotton and woolen textiles is by far the leading branch of manufacturing in the Republic, (2) cotton furnishes 24 per cent of the total exports, (3) ten factories turn out about one-half of the cotton goods requirement of the country, (4) five mills produce one-third of the consumption of woolen goods other than the native product of the highland Indians, the purchase of foreign textiles constitutes 20 per cent of the total imports (Fig. 14). While the local mills turn out a variety of products, their strength lies for the most part in the cheaper, coarse fabrics suited to the great mass of the population. The cotton mills specialize in shirtings, sheetings, overall cloth, and drills—lines in which the domestic products enjoy special advantages for they enter the market in retail establishments at prices from fifteen to twenty per cent lower than imported articles. The woolen mills manufacture chiefly cassimeres, blankets, and shawls, while the household industry of the Andean region turns out various articles of clothing for consumption in that area.

COTTON GOODS

Cotton goods, both cheap and expensive fabrics, make up one-half of the receipts of textiles. They lie within the buying power of a majority of the population; the low purchasing power of most of the people force them to buy low-priced foreign blankets made of a fine cotton warp and a filling of low-grade cotton waste. Also, a cheap cotton cloth is imported for making ponchos, a garment worn by a large proportion of the population. Cotton goods are especially suited to the high temperatures of the coastal desert where the chief market exists.

The United Kingdom leads in the shipments of cotton textiles to Peru enjoying a monopoly in the trade in threads, fine white goods, plush and velvet, gray goods, suitings, and handkerchiefs. Germany follows and supplies cheap blankets, hosiery, ribbons, trimmings, and shirts. The British have been in the market for a long time, while German merchants have studied the special wants of the people and have made cheap articles to meet the needs.

WOOLEN TEXTILES

Woolen goods, although more suited than cotton fabrics to the climatic conditions of the regions where most of the people dwell, make up only one-fourth of the textile imports. The isolated and backward highland Indians, who constitute about three-fourths of the population of the Republic, produce most of their clothing requirements from the fleece of their flocks. The Indian women are experts in spinning and weaving; one of the most common sights throughout the highland area is an Indian woman spinning or knitting as she tends the flocks on the open ranges. The weaving is usually done in a very primitive manner (Fig. 17). Therefore, the market for foreign woolens, as with other textiles, lies largely in the coastal desert cities and valleys. Even here it is restricted, owing to the general use of cottons as clothing for men, cassinettes taking the place of woolens to a large extent and to the production of cassimeres, blankets, and robes by the local mills. As with cotton textiles, the United Kingdom leads in supplying

FIGURE 17.—Out of the fleece of their flocks, the highland Indians produce most of the clothing they use, and, therefore, buy few textile goods from overseas. The weaving is done, for the most part, by the native women on small crudely fashioned looms.

woolen fabrics, while Germany and Italy follow with most of the remainder.

SILK

Silk goods make up only three per cent of the total trade. Silk is too expensive for all the people, except the more well-to-do members of the upper class. It is not suitable for use in the cold Andean highlands and does not give comfort at night in parts of the coastal desert.

The leading items in the silk trade of the country are plush and velvet, neckwear, ribbons, and hose. The first two are used extensively for women's apparel, the former for coats and wraps, and the latter chiefly for dresses. The United Kingdom leads in this class of silk goods, while two-thirds of the ribbons come from Germany and the hose chiefly from France. The silk market in Peru at best is restricted to small purchases.

JUTE, HEMP AND LINEN

The other textile imports constitute three per cent of the total imports and consist of jute, hemp, and linen articles. The first two in the form of sacks or sacking account for three-fourths of the purchases in this group. They are used for shipment of minerals, cotton, sugar, and cottonseed. Peru spends each year about one-half of a million dollars for these bags. In contrast to these, linen, being rather expensive and adapted to other uses, enters a restricted market among the upper class as collars, handkerchiefs, thread, and to a smaller extent as shirting and duck.

TIMBER AND ITS MANUFACTURES

While about one-half of the area of Peru supports a forest growth and adobe and stone constitute the chief house-building materials, lumber and its products make up five per cent of the total imports of the country. The forest resources of Peru consist almost entirely of the mixed hardwood tropical forest in which practically no species supplies material adapted to the present needs of Peru. The forests are inaccessible under present conditions of transportation from the coastal and central Andean regions, the areas which require these materials. Therefore, Peru affords a steady and dependable market for lumber.

The United States now supplies practically all of the lumber imports of Peru, except for small amounts of Central American cedars and minor shipments of wood from Chile and Ecuador. About 90 per cent of the lumber receipts of Peru consist of Douglas fir from the Pacific coast of the United States. It is the general utility lumber of Peru and serves a variety of purposes in general construction and even in the making of furniture. It also makes mine timbers. Some oak and ash for furniture and spruce for boxes come from the United States.

The greater part of the lumber entering Peru is consumed in general building construction in the chief cities. Other important uses include that for mine timbers, furniture making, and railway ties. Approximately 80 per cent of the lumber receipts of the country enter the port of Callao and are used in the capitol district and in the mining region tributary to this port over the Central Railway of Peru. The Cerro de Pasco Copper Corporation alone takes almost one-third of the total lumber imports. Near Lima, the expanding new suburban sections demand more modern structural materials to replace in part the adobe or sun-dried bricks characteristic of the coastal desert. The remaining 20 per cent of the lumber receipts enter about equally the rapidly developing petroleum region of Northwestern Peru, the sugar and cotton estates in the Salaverry-Trujillo district, and Arequipa, the commercial metropolis of southern Peru.

While Peru possesses extensive timber lands, they lie in the remote and highly isolated section of eastern Peru. In these tropical forests, the trees of any one species are not found in clumps or relatively pure stands, but are scattered promiscuously throughout the forests. With present demands for only a few of the trees in an area, large-scale produc-

tion of a single species in a given locality is impossible. As a result the excessive cost of exploitation of the forests and the lack of adequate transportation facilities prohibit production in significant proportions. Therefore, imported lumber will continue to enter an open and expanding market both as to quantity and variety.

PAINTS AND DYES

While Peru produces practically no paints, police regulations require the painting of buildings every two years. Paints and dyes constitute only four per cent of the total imports of the country; yet the demand for them is not large.

A majority of the buildings, even in the cities, not to mention the rural district, are made of adobe or of sun-dried brick and as they have an unfinished surface, they require no paint. The interior of buildings, if finished at all, are calcimined or covered with paper and thus need little paint. However, when lumber and other structural materials replace adobe, paint is used.

The growing textile industry of the Republic requires increasing amounts of dyes for the variety of products now being made. Any further expansion along this line will call for more of these associated raw materials.

The United States and England hold much of the trade in paints, while Germany has the lion's share of the dye trade.

DRUGS AND CHEMICALS

In Peru, as in most South American countries, where modern medicine and sanitation are making rapid strides forward, the receipts of drugs and chemicals constitute significant import commodities. They make up four per cent of the total trade in Peru. Disinfectants are widely used in the coastal desert; they are sprinkled on the floors of street cars, stations, stores, and private residences. Pharmaceutical specialties and proprietary compounds are purchased on the average to the amount of one million dollars each year. Sodium compounds also are imported in considerable quantities in spite of the fact that Peru holds rather large deposits. In this class of goods, the United States leads, having almost one-half of the trade.

PAPER

Peru, a country strikingly deficient in paper-making materials, especially in the coastal desert and Andes Mountains where most of the people live, has to look to foreign sources for her supplies of paper. While a variety of classes of paper are imported, newsprint comprises nearly one-half the total receipts. It is used not only for printing, but also for wrapping purposes, a use which developed during the war when the cheaper wrapping papers could not be secured.

The market for printing paper, book paper, tissue paper, and wall paper is restricted in Peru. Probably more than 78 per cent of the population of the country can neither read nor write. Therefore, the circulation of letters, magazines, catalogues, and books is confined to the small upper class in the more important cities. Peruvian manufacturers issue no catalogues and local business houses do not appreciate the value of attractive folders and booklets in selling. Tissue paper (for toilet purposes) has a small sale, for its use is confined to the wealthy classes in large cities. Neither is it used for wrapping. Wall paper, like the others, finds a market only in the few large cities, since a majority of the houses in Peru are made of adobe, the inner walls being coated with cold-water paint or calcimine. Yet with only these restricted uses, paper equals 3 per cent of the total imports, ranking in value ahead of coal and coke.

COAL AND COKE

Despite the facts that (1) Peru ranks as one of the three petroleum-producing countries of South America, (2) the country has rather large deposits of good grade coal, and (3) coal is not used for heating the average home in the coastal

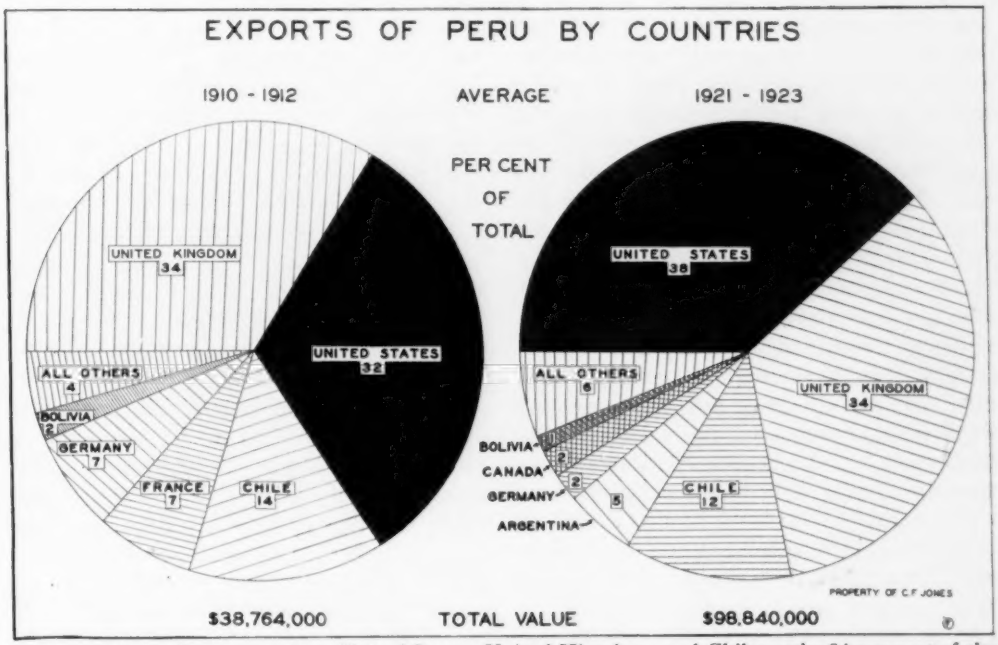


FIGURE 18.—Three countries—United States, United Kingdom, and Chile—take 84 per cent of the total exports of Peru. The United States buys especially minerals, petroleum, and some cotton; the United Kingdom takes nearly all the cotton exports and 37 per cent of the sugar; Chile purchases petroleum products and sugar.

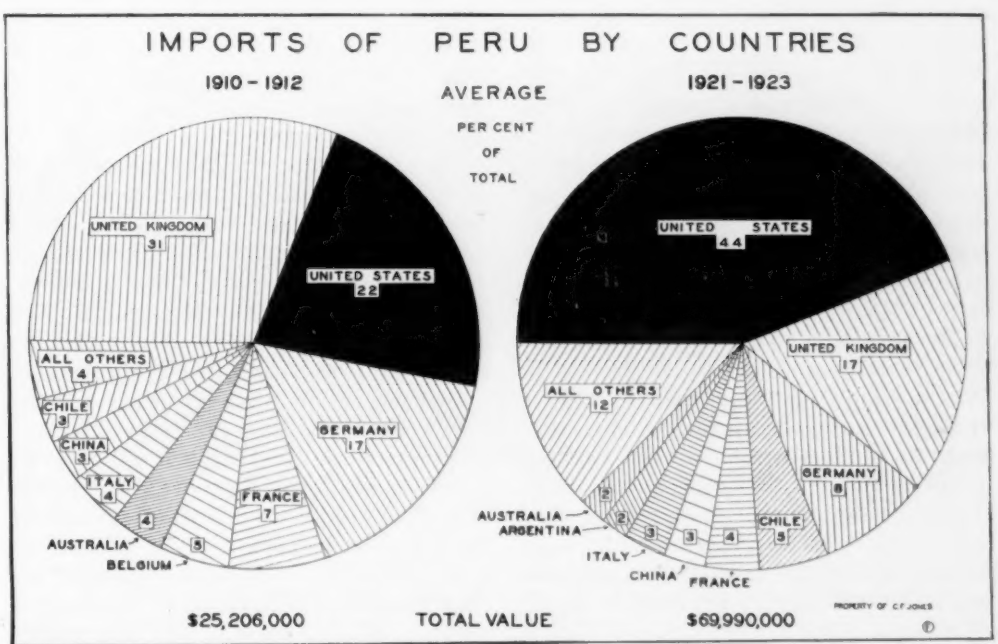


FIGURE 19.—The dominant position which the United States now holds in the import trade of Peru has been won almost entirely during the present century. At the same time, the trade of other countries with Peru in most cases has increased considerably in total value but decreased greatly in percentage of total; in other words, the United States has largely supplied the growing demands of Peru for manufactured wares, the other countries just being able to hold their former trade.

desert because of high temperature, and in the highland owing to the low purchasing power of the Indian, coal and coke receipts rank as significant imports. Seventy-five per cent of the petroleum produced enters foreign trade, the remainder being consumed largely as petroleum derivatives and not as fuel oil. The coal deposits of the Republic all lie in isolated sections of the highland and are exploited only in connection with some of the mining camps.

The chief consumers of imported coal and coke are the large mining companies of the Andean region, the railways, the steamship companies, and some of the larger manufacturing plants of the Lima district.

As in other South American countries, the United Kingdom dominates the coal trade of Peru, supplying about two-thirds of the receipts. It moves from England on especially low rates as ballast on ships en route to the West Coast for bulky cargoes. With mining developments, and larger industrial activity, the markets for coal and coke will expand.

TRADE BY COUNTRIES

Although a number of nations share in the trade of Peru, four countries—the United States, the United Kingdom, Chile, and Germany—dominate commercial activities. They take 86 per cent of the exports of Peru and supply 74 per cent of the imports. South American countries play a more important part in the percentage of total trade of Peru than they do in that of Argentina or Brazil. They consume almost one-fifth of the exports and supply about one-tenth of the imports. As Peru's principal exports, with the single exception of sugar, are raw industrial materials, they flow naturally to the large manufacturing regions, which likewise supply the manufactured wares needed by Peru.

THE UNITED STATES

The United States occupies the leading position in both the export and import trade of Peru, taking 38 per cent of the former and supplying 44 per cent of the latter (Figs. 18 and 19). This commanding position in the commerce of the country has been won almost entirely during the present century, for in 1899 the United States took only four per cent of the exports and furnished eight per cent of the imports. A marked growth has come since the opening of the Panama Canal and the beginning of the World War, two events which have been primary factors in the trade expansion of the United States in western South America. At the opportune time, the opening of the Panama Canal made it possible to lay down in the Atlantic ports of the United States over almost a great circle route from the Pacific coast of South America, bulk cargoes of nitrates, copper, and petroleum for our factories operating under war time capacity and for the post-war supply of American metallurgical, electrical, and chemical industries. The American portion of Peruvian trade rose to about 62 per cent of both the exports and the imports in 1916. Of course, with the cessation of hostilities in Europe, and the post-war commercial activities of those countries, the position the United States held could not be maintained.

The importance of the United States to Peru as an export field is indicated by purchases from Peru. The United States takes about 15 per cent of the exports of sugar, 14 per cent of the cotton, 32 per cent of the petroleum (Fig. 20), more than 90 per cent of the copper, silver, and vanadium, and appreciable quantities of the minor export commodities. The purchases of sugar in Peru have decreased markedly since the enactment of the tariff law of 1922, which gives preference to Cuba and Hawaii. The United States buys special long staple cotton from Peru for mixing with short fiber American cotton. The movement of almost one-third of the petroleum shipments of Peru to the United States results from money invested in the oil industry, the extensive seaboard refineries, and large world trade in petro-

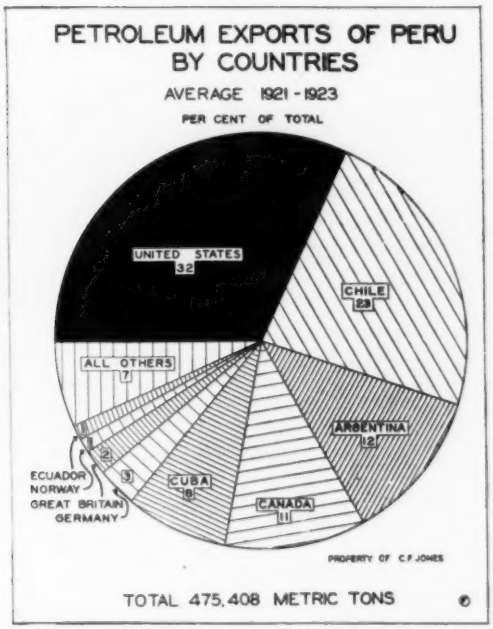


FIGURE 20.—Four countries take more than three-fourths of the exports of petroleum products of Peru. One-third or more is consumed in other countries of South America.

leum products. The United States takes most of the copper, silver, and vanadium owing to American ownerships of the mines, and to the great need of these raw materials in the factories of this nation.

The chief Peruvian purchases from the United States include, in the order of value, machinery, structural steel, miscellaneous iron and steel articles, automobiles, lumber, lard, and textiles. In the machinery (except textile) and iron and steel market, the United States enjoys special advantages owing to the uniform high quality of the product, the promptness of delivery because of nearness to the market, the extensive production of standardized parts easy to procure, and the large investment of American capital in Peruvian enterprises. The American capital in Peru amounts to one hundred million dollars. In Peru, as in Brazil and Argentina, the United States dominates the market for automobiles, supplying 97 per cent of the imports. Superior styles, cheaper prices, excellent service, skillful advertising, promptness of delivery, and care in furnishing accessories favor a continued control of this market by American firms.

Recent trends in the import trade of Peru point to the increasing importance of the special advantages which the United States holds. American investments in mines, oilfields, and public improvements; supervision of city, port, and sanitary development work; control of the problem of irrigation; the growing demands in America for raw industrial materials from overseas; a greater dependence of the American manufacturer upon foreign markets; the prompt delivery of high-grade manufactured wares with standard parts and accessories—all are significant factors paving the way for the larger part the United States will play in the trade of the Republic with the passing of years.

UNITED KINGDOM

As in other South American countries, the United Kingdom was the first nation to take an active part in the commercial development of the Republic of Peru. British capital, shipping, and men, were largely responsible for the marked commercial expansion of the Republic during

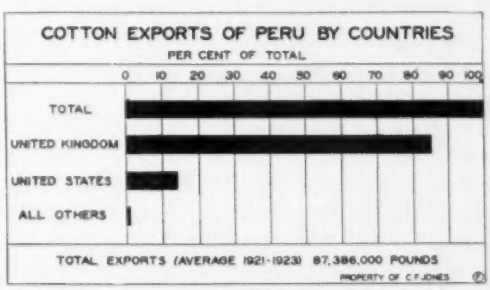

COTTON EXPORTS OF PERU BY COUNTRIES
PER CENT OF TOTAL
0 10 20 30 40 50 60 70 80 90 100
TOTAL
UNITED KINGDOM
UNITED STATES
ALL OTHERS
TOTAL EXPORTS (AVERAGE 1921-1923) 87,386,000 POUNDS
PROPERTY OF C.F.JONES

FIGURE 21.—The United Kingdom purchases eighty-five per cent of the cotton shipments of Peru and leads all countries selling textiles to that country.

the illustrious guano period; they saved the country from complete financial ruin at the close of the War of the Pacific through the formation of the Peruvian Corporation in which the investors have lost heavily.

Likewise, the United Kingdom was

the pioneer consumer of Peruvian raw commodities, taking as early as 1877 two-thirds of the total exports of the country. By 1891, this portion had dropped to about one-half, then to one-third before the war, 1910–1912, (Fig. 18). At the present time, the United Kingdom still buys about one-third of the exports. The textile mills of England take 85 per cent of the cotton and 75 per cent of the woolen shipments of Peru (Fig. 21). The country purchases 37 per cent of the Peruvian sugar exports and small quantities of the petroleum and other minerals.

When the United Kingdom took most of the surplus products of Peru, she led in supplying the markets of that country. From 1877 to 1900 she furnished about one-half the total imports, other European countries adding another one-fourth. During the first decade of the present century, Peruvian purchases from the United Kingdom decreased with competition from other European countries and with the United States. England supplied 31 per cent of the total in 1910–1912, but in 1921–1923 furnished only 17 per cent of the total; proportionally the trade had decreased greatly, but in actual value the shipments to Peru showed a considerable gain (Fig. 19). The United Kingdom leads all countries in sending cotton, woolen, linen and jute textiles, textile machinery, railway supplies, and coal; she entered these lines in the early days and has maintained first place in the face of competition.

The principal factors favoring trade between the United Kingdom and Peru are the large British investments in the country ($125,000,000 are invested in Peru, chiefly in railways, oil properties, mines, and *haciendas* in the coastal desert), the considerable English colony in the country, and, most of all, the great demand in industrial England for the raw materials and foodstuffs of Peru.

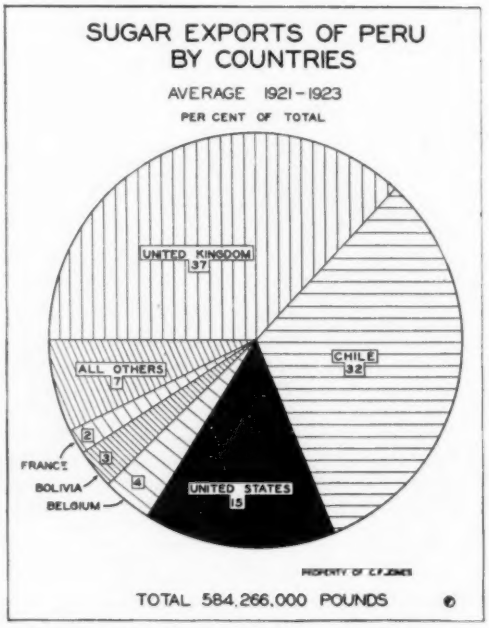


FIGURE 22.—Two countries buy a little more than two-thirds of the sugar exports of Peru. Shipments to the United States have decreased greatly since the enactment of the tariff law of 1922.

CHILE

With the exception of Chile, sister Republics of South America have a surprisingly small part of the trade of Peru; they, like Peru, are producers of raw industrial material and foodstuffs and buyers of manufactured wares. Bolivia takes one per cent of the exports, chiefly sugar and petroleum products, but sells practically nothing to Peru. Argentina accounts for five per cent of the exports of Peru, consuming especially petroleum products (Fig. 18), and supplies in wheat and flour about two per cent of the imports of the country.

Chile is the chief South American buyer of Peruvian products. Its share of the export trade averaged between 10 and 14 per cent between 1891 and 1923. The bulk of the trade is made up of sugar (Fig. 22), petroleum, and cottonseed products. Chile takes the raw crude sugar of the coastal valleys of her northern neighbor and refines it for home consumption. She lacks the water for sugar cultivation in her coastal desert. Chile is the leading purchaser of Peruvian fuel oil and an important buyer of gasoline and kerosene; the former is con-

sumed largely in the great nitrate plants of the northern part of the country.

In the import trade Chile supplies only five per cent of the total. This portion is made up largely of wheat and flour from the Central Valley and of forest products from Southern Chile. The trade between these two countries consists of raw products, which is in contrast to that between Peru and the other leading countries sharing the commerce.

GERMANY

Before the World War (1910–1912), Germany was a fair consumer of the raw products of Peru, ranking fifth with two per cent of the total, but was more important in supplying manufactured wares to that country. She furnished 17 per cent of the imports, being a close second to the United States. While she dropped out of Peruvian trade during the war owing to the withdrawal of German shipping and the effective Allied blockade, she has staged a remarkable comeback. Her shipments to Peru comprise (1921–1923) only eight per cent of the total, yet in value they amount to more than pre-war figures.

A number of factors favor commerce between Peru and Germany. The German investment in Peru amounts to approximately $25,000,000, and represents huge agricultural estates, a large commercial firm in Lima, and the German bank—the *Banco Aleman Transatlantico*—significant factors in facilitating the activities of agents of German firms. Unusual price concessions or time payments aid the Germans materially in competing with other merchants. Also the German manufacturers produce a cheap commodity for the *price market* of the country, especially in electrical goods, textiles, certain classes of machinery, tools, and toilet preparations. So long as the Peruvians buy on a price basis, such goods will take preference over high-quality products from other countries.

TRADE POSSIBILITIES

The developments in Peru during the present century have thrown into the commercial marts of the world in increasing quantities a number of staple commodities—sugar, cotton, petroleum, copper, vanadium, rubber, and wool. These articles have given Peru for the first time in her history commercial stability. They will be required in larger and larger quantities as the world moves onward and upward in its march of progress. That Peru can continue to supply these at the rate of growth established during the last fifteen years is questioned.

The best authorities on Peruvian irrigation estimate that the output of the commercial crop of sugar and cotton in the coastal desert can be increased at a maximum not more than twenty per cent by the introduction of better methods of production, the adoption of standardized grading and marketing, and the construction of new irrigation works now under consideration.

Although the mineralized zones of the Andean highlands hold in their isolated recesses large and rich mineral deposits, known and probably undiscovered, they are remote from ocean outlets and untapped by adequate transportation facilities, prerequisites of exploitation. They are not for the small producer to develop, but they offer an investment field which requires very heavy initial expenditures backed by enormous financial resources before any returns on investments can be expected. Capital and energy with which to develop this mineral wealth must come for the most part from foreign sources, as Peruvians in general do not assume readily large financial obligations, even when they are able to do so from the standpoint of available money.

In addition, the petroleum pools are exhaustible, and with the inevitable decline in the output of the present fields even during this century, the petroleum districts will relapse into the quiet non-commercial repose of past ages and thus rob merchants of one of the best markets of present-day Peru. The Republic may have large oil pools in the Montaña but a lack of people, capital,

and means of transportation will delay for years any flow in Peruvian commercial channels of this possible resource. In fact, the possibilities of this vast territory as a whole have been fabulously overestimated.

While the glare of the brilliant rubber era on the eastern horizon of Peru focussed the attention of the Republic for a brief period of twenty years upon the great expanse of the little known tropical lowland portion of the country, it holds no "El Dorado" and can contribute but little to advance Peru as a commercial nation for a century and probably more. To the west of it rises the great Andean mountain and plateau barrier, an obstacle to transportation which has baffled the most daring engineers and railway men. Many projects have been launched for connecting this region with the Pacific Coast by rail. Although the most liberal concessions have been made to companies interested in the project and some routes surveyed, the rugged cold region is completely crossed only by narrow treacherous mule trails. Even today it takes about three weeks to go via the central trail from Lima by railway, automobile, muleback, canoe, and then launch to Iquitos, the heart of the Montaña, a distance of 1,410 miles. To the east the hot forested Amazonian plains stretch for more than 2,000 miles to the Atlantic. Within the region no roads yet exist; boggy, muddy trails serve as the only means of communication between the rivers.

The productivity of the Montaña is not questioned. The plentiful rainfall, the gentle relief, and the soil make it possible to grow cacao, cotton, tobacco, corn, and fruits. Yet, if agricultural settlers were to attempt the conquest of these lands, any surplus beyond the needs of the local population must seek distant markets; and the cost of sending these products over the ranges of the Andes to the Pacific or by way of the rivers to the Atlantic, would be so great that most of them would not even pay the cost of transportation.

At present, the Montaña is inhabited only by many tribes of uncivilized Indians and a sprinkling of Spanish and other descendants in a few scattered and highly isolated villages. The population density figures less than one person to every three and one-half square miles. Furthermore, the intense tropical heat of the lowlands, the excessive rainfall during the major part of the year, the imperfect drainage in the rainy seasons, the dense tropical forests, the prevalence of diseases, and the extreme isolation offer no attractions for settlers, not even the European emigrant longing for relief from the crowded conditions of the homeland. Most certainly European immigration cannot be directed to this far away region behind the Andes, until the pressure of population upon less remote and more healthful areas becomes several times more severe than at present.

The 600,000 whites in Peru comprise the ruling and largely the industrial and commercial class of the country. Literally, they are the Peruvians; they are suave, courteous, emotional, and hospitable almost to a fault, and they never let questions of business cramp their social obligations. Yet, it is upon this class of people that the commercial business and progress of the country largely rests. The Republic lacks a middle class to span the wide gulf between the thin veneer of civilization embodied in the ruling class and the Indians and mestizos dwelling in social and economic degradation almost at the bottom of the scale of civilization. Emigrants do not flock to Peruvian shores to create a strong middle class. There is little room for them in the coastal desert and they will not endure the hardships of life in the Andean zone. Therefore, with little possibility of building up a sturdy middle class from foreigners, the incorporation of the Indian and the mestizo, who comprise the bulk of the population, into the productive and commercial scheme of things in Peru becomes one of the major problems of the Republic. With most

of the fertile lands of the country in the hands of the upper class, the Indian may remain a laborer with nothing at stake except life itself, a bare living and physical pleasures. In addition, the towering Andean mountains and plateaus where most of the Indians eke out a poor existence have erected a topographic and climatic barrier which may forever keep the Indian in his native haunt, isolated and far removed from the social and commercial life of the country as a whole.

On the other hand, recent progress has given Peru a firm commercial foundation and a strong position among the South American Republics. A continued export movement, even on the present level, of the leading commercial commodities of the republic will afford a fertile import field worth careful and systematic development by the progressive manufacturing regions of the world.

AGRICULTURAL REGIONS OF NORTH AMERICA

PART II—THE SOUTH[1]

Oliver E. Baker

Agricultural Economist, U. S. Department of Agriculture, and Professor of Agricultural Geography, Clark University

THE HUMID SUBTROPICAL CROPS BELT[2]

THIS agricultural region is characterized by the production of subtropical crops and winter vegetables, with live-stock farming still dominant on the less accessible lands, and by the large proportion of the land area (87 per cent) that is forest and cut-over or marsh. The region occupies a belt of low coastal plain 20 to 100 miles wide bordering the Gulf of Mexico from Matagorda Bay, Texas, eastward, including nearly all of Florida, and extending northward along the Atlantic Coast to Charleston, South Carolina, a distance of 1,200 miles. The climate is too moist, especially in the autumn, for the profitable production of cotton. The northern and western boundary of the region is drawn through those counties to the north or west of which cotton becomes the leading crop, based on value (Figs. 40 and 56). This line also marks approximately the inland margin of the Flatwoods and the extreme northernmost limits of the orange and the palm (palmetto). The area of the region is about 66 million acres, or 3½ per cent of the entire area of the United States, and in it were produced in 1919 crops valued at 244 million dollars, or 1½ per cent of the total for the United States.

[1] Part I, "The Basis of Classification," appeared in the October, 1926, issue of this magazine. This first article and the colored map of agricultural regions which accompanied it, afford a helpful introduction to the more detailed description of the regions given in this and succeeding articles. Three corrections should be noted in the colored map: The portions of the Frazier and Columbia valleys in British Columbia and Washington should be light yellow, as they constitute a part of the Grazing and Irrigated Crops Region; Iceland should be left uncolored; and credit should be given to F. J. Marschner, H. L. Shantz, and W. E. Ekblaw for assistance in preparing the map.

[2] Much of the material presented in this article was prepared originally by the author for the "Book of Rural Life," copyrighted in October, 1925, by the Bellows-Durham Company, Publishers, of Chicago.

THE PHYSICAL CONDITIONS

Climatic conditions are the major factors that have influenced the development of agriculture in the region, but topographic and soil conditions have also been important, especially in determining local differences in land utilization.

Climate

The Subtropical Crops Belt has a warm, equable, and moist climate, with a mean summer temperature of 80° to 82°, and a mean winter temperature ranging from 51° along the northern border to 70° in southern Florida. Winter frosts occur occasionally in most parts of the region, often doing serious damage to the vegetable and fruit crops, but are very rare on the immediate coast. (See Fig. 4 of Part I in the October, 1926, issue of this magazine. All figure numbers below 40 refer to this first article.) The annual rainfall, except along the Texas coast, ranges from 50 to 60 inches (Fig. 3). Although it is greater in summer than in winter, especially along the west Florida coast, where thunder storms are more frequent than elsewhere in the United States, the rainfall is usually abundant at all seasons and frequently interferes with farming operations, especially haying (Fig. 56). However, winter and spring in most of Florida are drier than along the North Atlantic Coast, and the many bright days are very pleasant. Largely as a consequence of the mild and bright winter weather, the southern Florida portion of the region especially has developed

into one of the two great winter playgrounds of the nation.

The Surface of the Land or Topography

The land is generally level, becoming gently rolling only in the hammock lands of central and northern Florida. Nowhere does the elevation exceed 300 feet, in fact, it is mostly under 100 feet. Swamps or wet prairies are frequent near the coast and along the rivers (Fig. 41). Back of the barrier beaches and lagoons along the Florida and Georgia coast, pine forests, locally dotted with lakes, extend inland over the flat, sandy country as far as the eye can reach (Fig. 42). The Louisiana coast is bordered by a marsh grassland, the breeding grounds of water fowl, back of which lies a flat prairie. In most of the Texas portion of the region this prairie extends to the coast.

Soils

The soils, derived from sediments deposited in shallow ocean water when the land was lower, are largely sandy or loamy and commonly of low fertility, except in Louisiana and Texas, where the Mississippi River delta and Coastal Prairie soils are of heavier texture and, in general, quite fertile (Fig. 60). In Florida where the soil is mostly sandy, though locally underlain by silt and clay within a few feet, large quantities of fertilizer are used, especially in the trucking and citrus fruit districts, and smaller quantities in other portions of the region (Fig. 61). The low fertility of the soil outside the river delta and prairie districts, the swampy conditions of much of the land, and, particularly in the past, the malaria common in parts of the

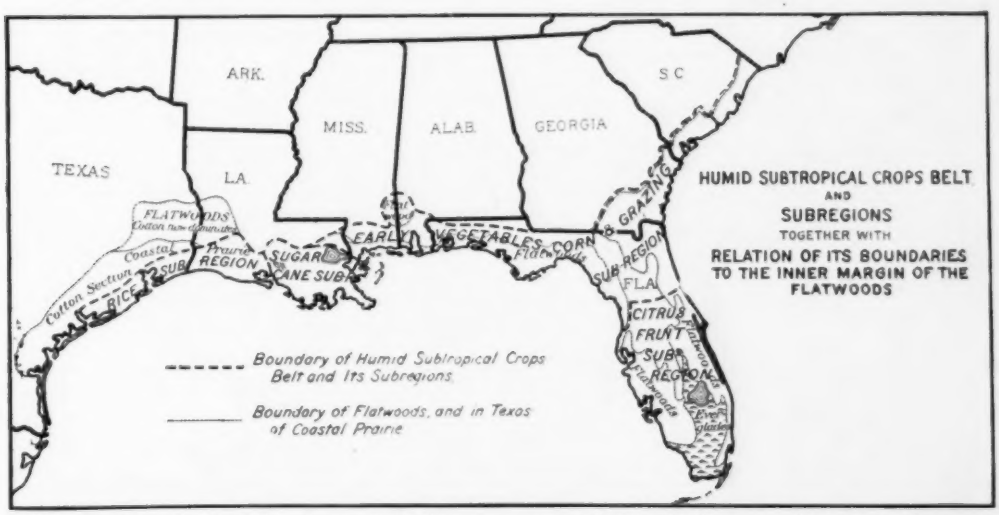


FIGURE 40.—The boundary beyond which cotton ceases to be the leading crop, based on value, and, therefore, the northern boundary of the Humid Subtropical Crops Belt, follows in a general way the line of 10 inches autumn rainfall (see Fig. 56). But the precise location of the line in South Carolina and across Georgia in 1925 practically coincided with the inland margin of the Flatwoods, which are characterized by poorly drained soils. Formerly the Cotton Belt extended to the inland margin of the Flatwoods in Florida, also (only as far south as Suwanee County), but after the arrival of the boll weevil, which augmented the influence of both moisture and temperature conditions, the southern boundary of the Cotton Belt was pressed back into the second tier of counties in Georgia. Here it remained for several years. By 1925, owing to higher prices for cotton and better means of controlling the weevil, it had advanced to the Florida line.

Similarly in western Louisiana and southeastern Texas the coming of the boll weevil forced cotton almost entirely out of the Flatwoods district, and in 1919 the boundary still remained along the northern margin of this district. But by 1924 cotton had regained its position as the leading crop in this Flatwoods area, despite the poorly drained character of the soil. In the southern tip of Alabama, however, although the soils are suitable for cotton (except the Flatwoods of Washington County), the heavy rainfall and the development of the trucking and fruit industries have kept cotton from advancing farther south.

region, have retarded agricultural development.

The soils have been very influential in determining which of the subtropical crops shall be grown in the different parts of the region, and in conjunction with the smaller local differences in temperature conditions cause the region to be divided into four sub-regions (Fig. 40).

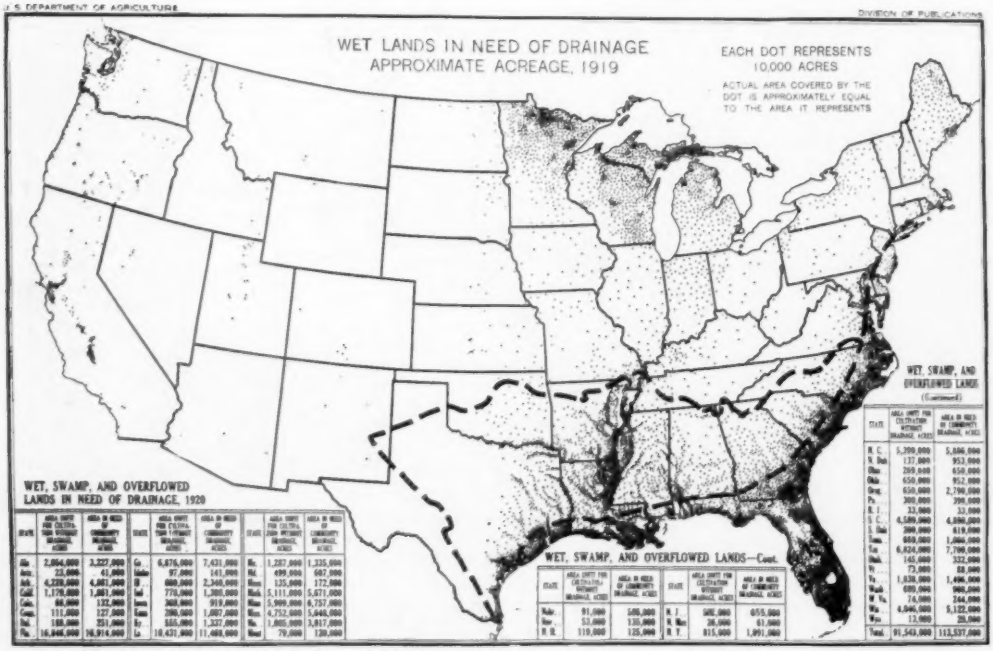

WET LANDS IN NEED OF DRAINAGE
APPROXIMATE ACREAGE, 1919
EACH DOT REPRESENTS
10,000 ACRES
ACTUAL AREA COVERED BY THE DOT IS APPROXIMATELY EQUAL TO THE AREA IT REPRESENTS
WET, SWAMP, AND OVERFLOWED LANDS IN NEED OF DRAINAGE, 1920
WET, SWAMP, AND OVERFLOWED LANDS—Cont.

FIGURE 41.—The Humid Subtropical Crops Belt contains about 36 million acres of wet land unfit for cultivation without drainage, or nearly 40 per cent of the total acreage in the United States. About 30 million acres more, or a third of the nation's total, is found in the Cotton Belt. There is from two to three times as large acreage of wet land awaiting drainage in the South as there is dry land in the West for which irrigation water could be provided. But less than six million acres have been drained so far in the South, as compared with 20 million acres irrigated in the West. (Map from 1921 Yearbook, U. S. Dept. of Agriculture.)

1. The Rice Sub-region, which corresponds with the heavy clay coastal prairie soils in southwestern Louisiana, but includes only about half the coastal prairie in southeastern Texas. The area of this sub-region is about 9,000,000 acres. One-third of the land area was in farms in 1924, and one-ninth was in harvested crops. The sub-region contained about 25,000 farms in 1924, an increase of one per cent since 1919.

2. The Sugar-Cane Sub-region on the rich alluvial soils of the Mississippi River delta. The area of this region is about 5,250,000 acres. Less than one-third of the land (1,500,000 acres) was in farms in 1924, and only a little over one-ninth (600,000 acres) was in crops. This sub-region contained about 13,000 farms in 1924, a decrease of one per cent since 1919.

3. The Gulf and South Atlantic Early Vegetable, Corn, and Grazing Sub-region, which includes the sandy to loamy soils of Louisiana east of the Mississippi River, of the southern tips of Mississippi and Alabama, of northern Florida and southern Georgia and of southeastern South Carolina. The area of this sub-region is about 35,000,000 acres. Less than one-fourth of the land (about 8,500,000 acres) was in farms in 1924, and less than one-tenth (about 3,000,000 acres) was in crops. The sub-region contained about 85,000 farms in 1924, a decrease of 5 per cent since 1919.

Along the northern margin of this

sub-region in northern Florida and southern Georgia, there are two districts in which tobacco is the most valuable crop.

4. The Citrus Fruit and Winter Vegetables Sub-region on the sandy and mucky or peaty soils of southern Florida. Climatic conditions, not soils, determine the separation of this sub-region from that above. In this southern portion of Florida the winter cold-waves are sufficiently ameliorated by the warm ocean water on each side of the peninsula and by the little lakes that dot the surface of the sub-region to permit the profitable production of citrus fruits. The area of this sub-region is about 13,000,000 acres. About one-sixth of the land (2,230,000 acres) was in farms in 1924, and one-twenty-fifth (510,000 acres) was in crops. The sub-region contained 23,000 farms in 1924, an increase of 50 per cent since 1919.

AIRPLANE VIEW OF WINTER HAVEN, FLORIDA

FIGURE 42.—This extraordinary picture shows the level character of the land in the Subtropical Crops Belt; the large number of lakes which are found in parts of central Florida; the rows of orange trees, some of which have been cut down to make room for houses and hotels; the railroad; the streets; the highway; and a few palms along the lake shores, suggestive of the subtropical climate—a very unusual ensemble to obtain in a single photograph. (Courtesy of R. E. Dahlgren and Winter Haven Chamber of Commerce.)

LAND UTILIZATION

Three-fourths of the Subtropical Crops region was originally covered with forest, the prairies and marshes in southeastern Texas and southern Louisiana, and in southern Florida, comprising the other fourth of the area. (See Fig. 9 of the article in the October issue.) About 12 per cent of the originally forested land has been cleared for agricultural use, and about 20 per cent of the original prairie and marsh area is now classified as improved land. For the region as a whole, 25 per cent was in farms in 1924. Of this farm land 46 per cent was crop land and plowable pasture, or 11 per cent of all land in the region (Fig. 11). Of the plowable land 60 per cent was in harvested crops or 7 per cent of the land area of the region. In other words, it is a frontier land, like the Spring Wheat Region far

TYING UP TOMATO VINES IN MISSISSIPPI

FIGURE 43.—The growing of vegetables and fruits for the winter and spring markets of the North is one of the principal industries of the Humid Subtropical Crops Region. (Photograph by J. S. Drake, formerly of U. S. Dept. of Agriculture.)

to the northwest, and despite the fact that settlement has been in progress over 200 years, agricultural development is scarcely more than started. There are fully 30,000,000 acres of potentially arable land in the region, which is over five times the present crop area, but the prices of agricultural products must be higher before it will pay to clear or drain much of this undeveloped land.

The Crops

The agriculture of the region is strongly influenced by the warm marine climate and the dominantly sandy soils, except in the river delta and coastal prairie districts, where the soils are mostly silts and clays. The mild winter temperatures and the early, easily tilled soils, except in the coastal prairie district, have caused the development in many localities of intensive types of farming, notably the production of winter vegetables, early potatoes and sweet potatoes in Florida, southern Georgia, eastern South Carolina, and around New Orleans (Figs. 43 and 44), and of subtropical fruits in southern Florida, and, to a less extent, along the Gulf Coast (Figs. 45 and 48). In the lower Mississippi delta of Louisiana, as already noted, sugar cane is the leading crop (Fig. 46), while west of the delta the clay soils of the coastal prairies have become the leading rice-producing lands of the New World (Fig. 45). Corn is an important crop throughout the region, except in southern Florida, constituting over one-third of the acreage of all crops in the region as a whole (Fig. 47), and the annual legumes, notably velvet beans and peanuts, are increasing in importance, constituting in 1919 one-sixth of the acreage of all crops. The harvested crops average nearly 30 acres per farm, and the average value of the crops per farm in 1919 was about $2,100, which gives the very high average value of over $70 per acre.

Pasture

Only about 20 per cent of the improved land in the region is in pasture, and east of Louisiana the proportion falls to 12 per cent; in other words, in the eastern

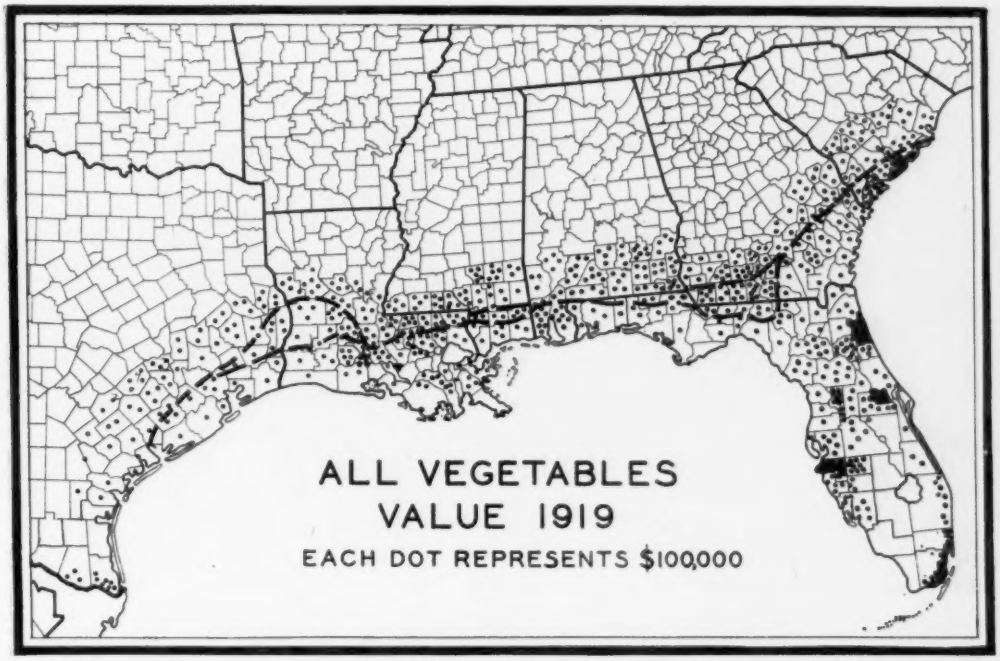


FIGURE 44.—In most counties of the Subtropical Crops Belt the value of the vegetables grown for sale is no greater than in adjoining counties of the Cotton Belt. Commercial vegetable production, it will be noted, is concentrated largely in a few counties in Florida and in Beaufort and Charleston counties, South Carolina. The counties in Florida producing over $1,000,000 worth of vegetables in 1919 were, beginning at the south, Dade, De Soto, Manatee, Sumter, Seminole, Putnam, and St. Johns. The divergent region boundary lines in Georgia, in Mississippi, and in Louisiana and Texas mark the extreme expansion and contraction of the southern boundary of the Cotton Belt. At present cotton has a greater value than any other crop as far south as the Georgia-Florida line from Echols County, Georgia, west; and it is also dominant in Louisiana as far south as the Rice Sub-region.

portion the acreage of plowable pasture is very small, averaging less than 6 acres per farm. Nevertheless, the production of cattle is one of the most important industries of the region. These cattle are grazed in the pine woods and cut-over lands, which are sufficiently open to permit the growth of a considerable quantity of "broom sedge" (andropogons) and wire grass (aristida longisita). About 2,000,000 acres of such woodland pasture in farms was reported for 1924 and undoubtedly a far greater acreage of similar woodland not in farms was used for pasture (Fig. 49).

Forests

The forests of the region, including cut-over land, much of which is restocking, cover about two-thirds of the land area. The forests, except in the Mississippi River delta, consist very largely of long-leaf, loblolly, and slash pines. On the bottom lands and delta of the Mississippi, cypress, tupelo, and red gum are the leading species of trees. These forests which supplied in 1919 about half of the turpentine and rosin produced in the United States and one-fifteenth of the lumber, contribute very largely to the income of the farmers as well as to that of the lumbermen of the region.

Livestock

Beef cattle on January 1, 1920, constituted 55 per cent of the total animal units[3] in the region, which is about the same proportion as in the Grazing and Irrigated Crops Region of the West, and

[3] An animal unit equals 1 horse or mule, cow or steer, 2 colts or calves, 5 hogs, 10 spring pigs, 7 sheep or 14 lambs, and 100 poultry. It is a roughly estimated unit by which to measure the relative importance of the several kinds of livestock from the standpoint of feed required.

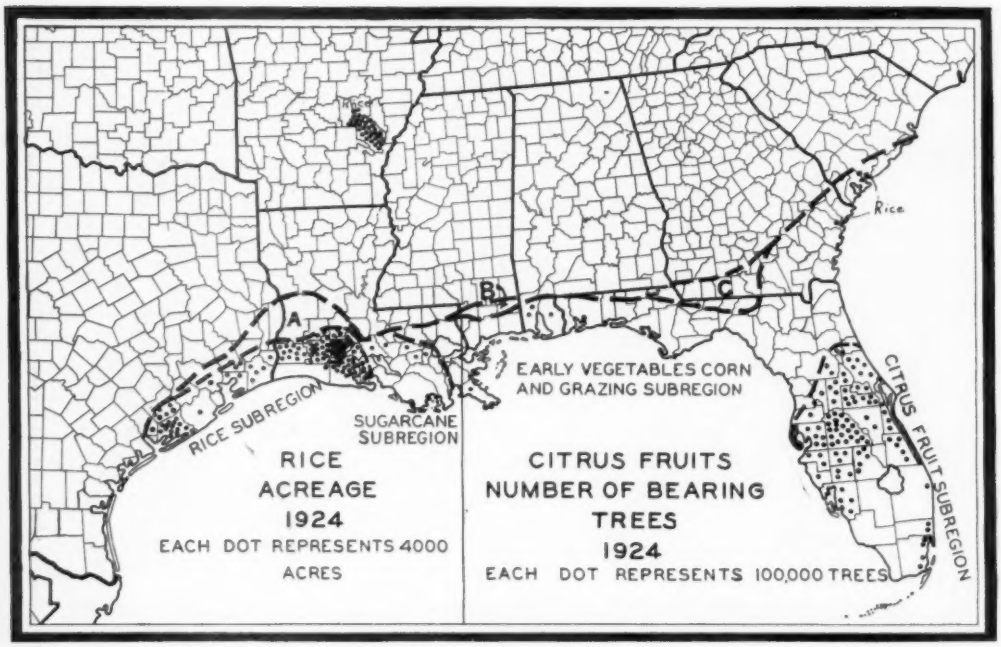


FIGURE 45.—Most of the rice in the Subtropical Crops Belt is grown on the Coastal Prairie of southwestern Louisiana and southeastern Texas (over 600,000 acres), but about 20,000 acres are devoted to rice in the lower Mississippi delta, where sugar cane is the dominant crop, and over 6,000 acres are still found in the old tidewater district of South Carolina and Georgia. In addition about 170,000 acres are devoted to this crop in Arkansas, and 100,000 acres in California. The citrus fruit (mostly oranges and grapefruit) is confined to the southern half of Florida, except for about 300,000 bearing and even more young Satsuma orange trees in Mobile and Baldwin counties, Alabama, and 100,000 bearing and somewhat more non-bearing trees in Plaquimines Parish in extreme southeastern Louisiana. The regions marked A, B, and C are intermediate in character between the Subtropical Crops Belt and the Cotton Belt.

more than double the proportion in any other eastern region. Dairy cattle were less than one-fourth as numerous, but receipts from sale of dairy products were surprisingly large, averaging over $56 per farm for all farms in the region. Horses and mules, used to cultivate the crops and haul them to market, constituted 16 per cent of the total animal units, and averaged 2½ per farm. There were 15 acres of crops per horse or mule. Hogs are raised to supply the local population with meat. Although they constitute only 11 per cent of the total animal units, the pork produced is worth almost as much as the beef. There are a few chickens in the region but almost no sheep, except along the northern margin. Most of the livestock, hogs as well as cattle, are grazed in the forest, cut-over, and other unimproved lands. In other words, the region is in part a ranching country, like the far West, but the large area of grazing land per animal is owing to the deficient

FIGURE 46.—Cane sugar production in the United States is confined almost entirely to the subtropical Mississippi Delta district of southern Louisiana, mostly to the portion south of Baton Rouge and west of New Orleans. A small amount of sugar is produced annually in Texas, and three sugar cane mills have been erected in Florida. (Map from 1923 Yearbook, U. S. Dept. of Agriculture.)

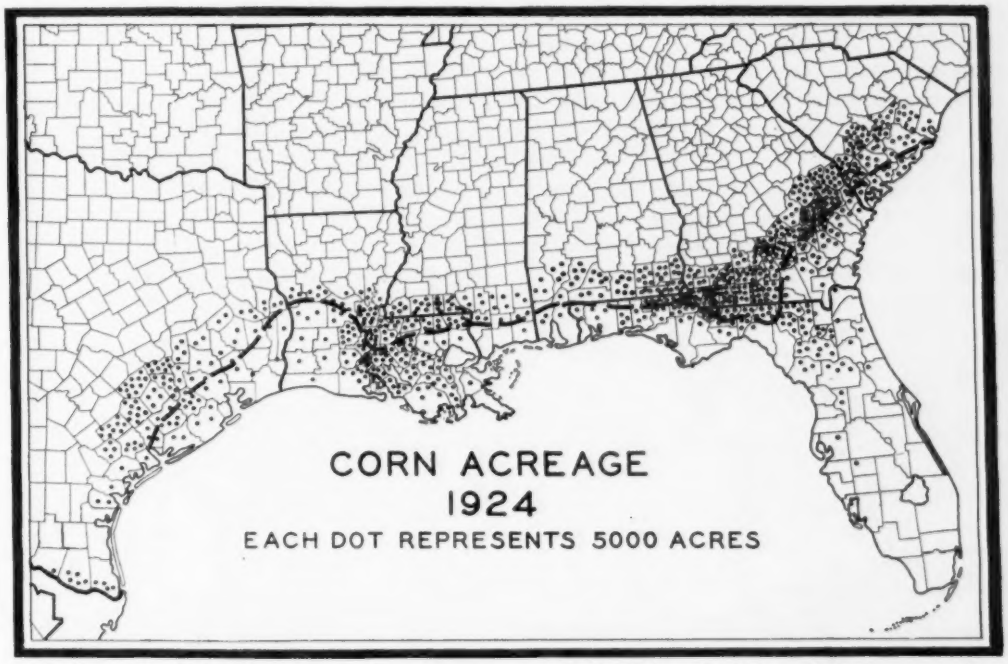


FIGURE 47.—Although corn occupies a larger acreage in the Subtropical Crops Belt than any other crop, there is not nearly as large acreage in this region as that even in the marginal portion of the adjacent Cotton Belt. The boundary between the two regions shown on this map is that which existed before the coming of the boll weevil, and corresponds more closely with the soil conditions than does the present boundary (see Fig. 40). The densest production in the Subtropical Crops Region, it will be noted, is found on the richer soils of the lower Mississippi delta (Sugar Cane Sub-region) and on the better "hammock" lands of North Central Florida. It will be noted, also, that almost no corn is grown in the Citrus Fruit Sub-region of southern Florida. Why so little corn should be grown in this warm humid sub-region is not fully understood.

fertility of the soil rather than deficient rainfall.

This contrast of intensive crop production, winter vegetables and citrus fruits

A YOUNG ORANGE GROVE NEAR LAKE ALFRED, FLORIDA

FIGURE 48.—The production of oranges and grapefruit is the leading agricultural industry in several counties of Florida. Note the level land surface, the modern character of the houses, their closeness together (six farmsteads are visible), and the occasional pine tree remaining from the original forest. (Photograph by W. C. Funk, U. S. Dept. of Agriculture.)

being among the most intensively cultivated crops in the United States, with the extensive cattle ranching, is also characteristic of the agriculture of the far West. The similarity extends even to the development of the tourist industry and of land-selling schemes. Subtropical climates seem to have an irresistible attraction to northern people, and as an appeal to the imagination is more effective than to the reason, it becomes an easy

TYPICAL WOODLAND PASTURE IN FLORIDA

FIGURE 49.—Grazing is an important industry in the Subtropical Crops Region. Many cattle companies operate large ranches in much the same way as companies located in semi-arid areas of the West. About two-thirds of the land in the Subtropical Crops Region is forest or cut-over land similar to that pictured above. (Photograph by J. S. Cotton, U. S. Dept. of Agriculture.)

matter, apparently, to sell large areas of the sandy lands to Northerners for prices far above their productive value.

SYSTEMS OF FARMING

The development of agriculture in this region, particularly the portion that lies east of the Mississippi River, involves some difficult problems. This is shown by the fact that only 7 per cent of the land area in this eastern portion of the region is in crops. These crops are not grown usually in rotation, as in the North, but the same crop is frequently grown many years in succession on the same land, the production being maintained by the use of fertilizers. The soils east of the Mississippi River, as already noted, generally are poor, and, consequently, crops are grown which are greatly favored by the mild climatic conditions; indeed, some cannot well be grown farther north. The crops should also possess a high value per acre, in order to repay the heavy expenditure for fertilizer that the soils require. Since cotton is practically excluded from the region because of the moist autumn weather that interferes with picking and discolors the lint, and also because of the mild winters that favor proliferation of the boll weevil, only two groups of intensively cultivated crops remain — subtropical fruits, and strawberries and early vegetables.

Cattle and Hog Production

But there is many times more land in this eastern part of the region than is needed to supply the demand for these fruit and vegetable crops, consequently most of the land is left in forest or used

A RAZORBACK HOG OF THE SOUTH

FIGURE 50.—"A New Jersey pork breeder who years ago showed beautiful, well-bred porkers in a cotton State fair," says J. Russel Smith in his delightful book "North America," "saw with amazement the premium put upon the razorback. He could not understand it at first. 'You see, Mistah,' said a native, 'them hawgs of yourn may be all right fer up Nawth where you come from, but thay ain't wuth five cents apiece heah. Youah hawgs ain't got no speed. Hawgs must have speed. Down heah, if a hawg can't beat a niggah to the swamp he ain't wuth having, for you won't have him long." Although many razorback hogs may still be seen in the South, it is only fair to add that pure-bred and grade hogs are increasing rapidly in numbers, and none other than a pure-bred could take a prize today. (Photograph supplied by Division of Animal Husbandry, U. S. Dept. of Agriculture.)

for grazing. The cattle and hogs that graze in the open pine woods and on the prairies need supplementary concentrated feed, hence corn is grown, a crop that yields more feed on sandy soils with only light fertilization than any other crop. Seventy per cent of the farmers grow corn and the same proportion have cattle. Peanuts and velvet beans, two forage crops tolerant of sandy land, are also often mixed with the corn, or grown separately, and used principally in feeding hogs and cattle.

This cattle, hogs, corn, and forage crop combination of enterprises, involving usually also woodland pastures, constitutes the most common system of farming in this eastern portion of the region, but the value of the subtropical fruits and early vegetables produced is much greater. Many of the cattle are owned by "poor-white" farmers struggling to make a living out of the sandy soil, and others are found on cut-over and prairie lands belonging to large cattle companies. Some of these companies own thousands of acres of prairie or of open pine forest, and graze many hundred head of cattle. Although many of the cattle are of a semi-wild type, the average value per head being only two-fifths as much as in the Corn Belt, and although the hogs are largely of the "razor-back" kind (Fig. 50), livestock constitute a much larger proportion of the value of farm property than in the Corn Belt. This is owing in part to the low value of the land and buildings. With the production of more forage crops, the gradual improvement in the quality of the cattle, and the eradication of the tick, this region seems likely to become a cattle producing region of considerable importance. Already many progressive farmers are introducing pure-bred stock, and feeding them on corn, velvet beans, and other forage crops grown on fertilized land.

Fruit and Truck

The principal areas of vegetable production are in central Florida and southward along both the east and west coast of the peninsula, in southwestern Georgia, and in the Mississippi delta south of New Orleans. Tangipahoa Parish, Louisiana, is noted for its strawberries. The production of citrus fruits, principally oranges and grapefruit, is largely concentrated in the southern half of Florida, but almost none are grown in the Everglades or on other poorly drained land. In the growing of citrus fruits and early vegetables heavy and frequent applications of fertilizer are made, as the soils are mostly of a sandy nature. Large expenditures for labor also are required, the cost of growing an acre of early vegetables or of citrus fruits being commonly ten times or more that required for corn, peanuts, velvet beans, or the other usual farm crops grown in the region. The truck and fruit growers are specialists, usually, who grow little else, and are frequently well-educated men, many from the Northern states. They have developed highly organized marketing

facilities, often of coöperative character, and in this way have postponed the overproduction and unprofitable price for their products which the wild speculation of the past few years in the lands of the region renders almost inevitable.

The increase between 1910 and 1920 in number of farms (35 per cent), in improved land (38 per cent), and in country population (28 per cent) in this portion of the region east of the Mississippi, was notable. Although a decrease in the number of farms and in cropland occurred between 1920 and 1925 in the early vegetables, Corn and Grazing Subregion, the increase continued in the Citrus Fruit sub-region. This was made possible largely by the increased use of fertilizers, the draining of considerable areas of land, and the expansion of the trucking and fruit industries. However, the limited market for fruits and vegetables must be taken into account by promoters of drainage projects. The draining of the Everglades, for instance, including both outlet and field drainage, will have cost when completed probably $100 per acre drained. The peat or muck soil is suitable for certain winter vegetables, but makes poor pasture, and is not very well suited to any of the major farm crops. Sugar cane is now being tried out, but the adaptability of the peaty soil to this crop is very uncertain. The drained area if all planted to vegetables would flood the market, consequently the problem arises of how to make land worth $20 an acre for pasture pay interest on a $100 per acre investment. There are many problems of this kind in the region which an investor should consider carefully.

With the market well supplied at present with subtropical fruits and early vegetables and less than one per cent of the land in these crops, it is evident that for the next 50 years probably 97 per cent of the land must be used for something else. Clearly the inevitable use for most of the land is for forest. The region grows excellent pine timber and, together with the adjoining coastal plain portion of the Cotton Belt to the north, produces over half of the turpentine and other naval stores of the world. Those who have the permanent prosperity of this region at heart will not promote further the booming of land values on the basis of use for fruit and vegetable production; but, instead, will urge a progressive pol-

HARVESTING SUGAR CANE

FIGURE 51.—Though this picture was taken near Brownsville, Texas, it might equally well have been taken in southern Louisiana. The cane is cut with a machete, a heavy knife. The cane after cutting is stripped of its leaves (shown in the foreground), topped, and then loaded onto a wagon, or more commonly a small freight car, and hauled to the nearby factory on the plantation railway. Often a million dollars or more are invested in the railroad and mill. (Photograph by C. E. Hoke, formerly of U. S. Dept. of Agriculture.)

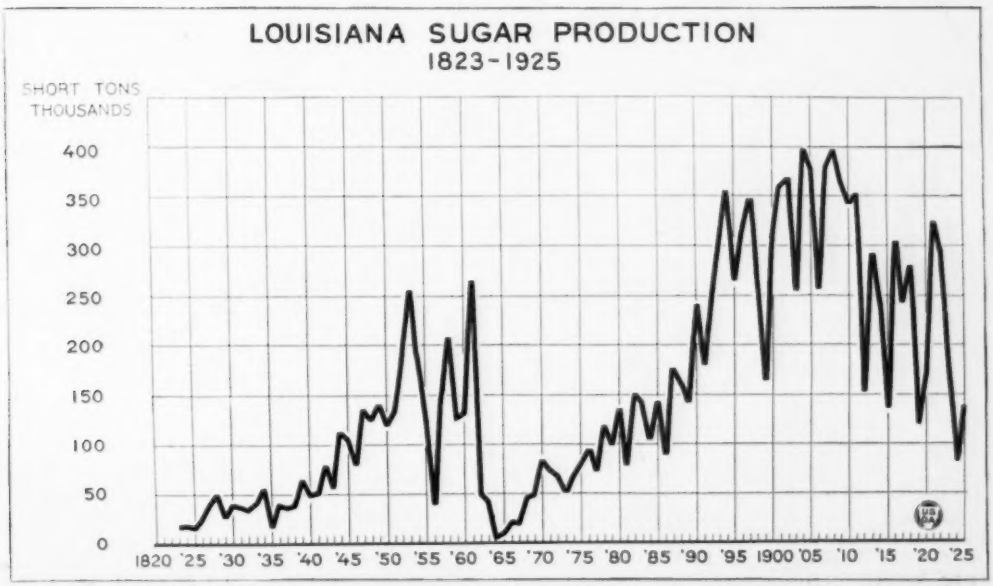


FIGURE 52.—The production of cane sugar in Louisiana increased rapidly until the beginning of the Civil War. During the period of the war production was reduced practically to nothing. From that time there was a more or less constant increase in cane sugar production until 1904–1908, after which period the production has trended downward with wide annual variations. (Graph from 1923 Agricultural Yearbook, brought up to date.)

icy of forest management that will produce an annual income from the 70 to 80 per cent of the land in this eastern portion of the region now yielding only an occasional product or lying waste.

Sugar Cane Production

In the delta of the Mississippi River and to the westward, the soils are more fertile, the delta soils, indeed, being among the richest in the world. This combination of rich alluvial soils and long growing season, aided by a high protective tariff, induced the development many years ago of sugar cane production and milling in the lower delta. Sugar cane is a perennial, but is replanted usually every second or third year because of decreasing yields. It is then followed by one, sometimes two years of corn and cow-peas. The cow-peas are usually plowed under for green manure. Many of the cane plantations are large, being owned and operated by the same company as the sugar mill. Two or three thousand acres of cane, on the average, are required to supply a mill and to cultivate this acreage requires 100 to 150 wage hands working much of the year and three or four times as many during the harvest season (November and December) (Fig. 51). Some of the sugar cane is also grown by small farm owners and some is grown by tenants.

The sugar industry in Louisiana has its problems also, the principal ones being how to produce sugar in competition with the cheap labor available to sugar planters in Cuba and other tropical countries, and how to restore the acre yield of cane lowered by the recent spread of several cane diseases (Fig. 52). The high wages paid by urban industries, especially in the North and in the nearby oilfields, have drawn many laborers from the cane fields in recent years, but more important has been the one-third to one-half decrease in acre yields due to disease. As a consequence this year (1926) the acreage is only about half that of a decade ago. But disease resistant hybrid varieties have now been developed by the Department of Agricul-

HARVESTING RICE IN SOUTHWESTERN LOUISIANA

FIGURE 53.—This picture, taken on the Lovell Plantation, 3½ miles from Crowley, Acadia Parish, shows the modern method of harvesting rice with binders similar to those used in the wheat fields of the North. As the rice approaches maturity the water is drained off the fields, the ground is allowed to dry out, and then the most modern harvesting machinery is used on the large plantations. (Photograph supplied by the Southern Pacific Railroad, through the Division of Cereal Investigations, U. S. Dept. of Agriculture.)

ture having as high yields as the old ribbon cane. Almost half the new acreage planted is of these disease resistant varieties, and the prospect for the industry is much brighter.

Although sugar cane has been the dominant crop, constituting over two-thirds of the value of all crops in this sub-region in 1919, winter vegetables are also grown in the Mississippi delta district, mostly near New Orleans, and a few citrus groves are found along the river south of the city. Rice growing is likewise an important system of farming in the delta, especially along the western margin. Rice constituted 13 per cent of the value of all crops in the sub-region in 1919. Livestock farming is unimportant in the Mississippi delta section, although dairying is carried on locally, principally to supply milk for the New Orleans market.

In the sugar cane district large areas of fertile land are lying idle at present. The number of farms and improved land decreased slightly between 1910 and 1920, while the "country" population decreased 15 per cent. The 1925 census shows that the decline still continues.

Rice Production

On the coastal prairies west of the delta district and extending westward to Matagorda Bay, Texas, rice is the dominant crop, constituting nearly three-fourths of the value of all crops in 1919. The rice sub-region includes about nine million acres of practically level coastal prairie land, lying back of the tidal marshes in a belt 25 to 50 miles wide and 250 miles long (Fig. 45). Six per cent of the area was in rice in 1919, and 6 per cent in other crops. The physical conditions which have favored the production of rice in this sub-region are the level surface, adapted to the use of the most modern seeding and harvesting machinery; the warm temperature, averaging 82° for the three summer months; the long frost-free season, extending usually from March 1 to December 1; the high rainfall, ranging from 40 inches annually at Matagorda Bay, Texas, to 50 and 55 inches in the Louisiana portion of the area, about half of which falls in the rice-growing season; and the sandy loam and black clay loam soils underlain by a tenacious clay sub-soil which prevents the irrigation water seeping away. All the rice is irrigated, but only about half the water needed is supplied artificially, the amount of water pumped from the rivers or bayous being about equal to the seasonal rainfall.

The fields are plowed and harrowed in a moderately dry condition, and the seed

sown. Irrigation water is then supplied and the depth increased as the rice grows until six inches is reached, which depth is maintained till near harvest, when the water is drained off, the land allowed to dry out, and the rice harvested by the same type of machinery used in harvesting wheat in the northwest (Fig. 53).

This rice industry is one of the finest examples of efficiency in agricultural production to be found anywhere in the world. The competition made possible by the cheap labor of Asiatic countries has been solved by the extensive use of agricultural machinery. This sub-region has been exporting rice to Japan and China, paying the cost of transportation half way around the world and selling at a profit.

Some years ago Dr. S. A. Knapp, a large rice grower, who later initiated and supervised the Coöperative Farm Demonstration work in the Department of Agriculture, gave the following figures of acres of rice per laborer and cost of labor per acre:

RICE—ACRES PER LABORER AND LABOR COSTS PER ACRE

Country	*Acres per Laborer*	*Farm Wage and Board per Year*	*Labor Cost per Acre*
Japan	½ to 1	$10 to $18	$10 to $36.
China	½ to 2½	8 to 12	4 to 6
India	3	10 to 20	4 to 7
Egypt	4	15 to 30	4 to 8
Italy	5	40 to 60	8 to 12
United States:			
Carolina	8	96 to 120	12 to 15
Mississippi delta	10	120 to 144	12 to 14
Louisiana-Texas	80	160 to 240	2 to 3

Although these figures, owing in part to changes in the value of the dollar, are no longer correct, their comparability as between the several countries is probably not seriously affected. The use of machinery and superior farm organization enables a man on these coastal prairies to cultivate perhaps 100 times as much land and produce probably 60 or 70 times as much rice as a man in Japan or China. The laborer can earn 15 to 20 times as large a wage and yet produce rice at one-half as great labor cost. He can live in a house instead of a hovel, as in China, need never fear starvation, and his children will receive an education. The farm owner can accumulate capital, with which to buy more machinery to produce more rice at a cheaper price. Thus laborer, farmer, and consumer are all benefited.

Cattle Ranching

The rice district was formerly the grazing grounds of thousands of cattle, and many large cattle ranches remain, particularly along the more swampy coastal margin. Since the grazing season is year long, these cattle ranches grow almost no crops, except a little corn. Cattle ranching along the Texas and Louisiana coast is almost purely pastoral but sedentary, in that it does not provide migration of the herds. Many ranch owners, however, spend only a part of the year on the ranch, their homes being located in some nearby city or village.

In the rice district the number of farms remained stationary between 1910 and 1920, the country population increased slightly, but the improved land increased 15 per cent. Between 1920 and 1925 the number of farms increased slightly and crop acreage notably. In this, as in many other regions where agriculture is prosperous, the trend is toward larger farms and more machinery, in other words, toward the use of more capital and less labor.

SIZE OF FARMS

The farms in the Subtropical Crops Region vary in area according to the crops grown and with the capacity and capital of the farmer. The average for

the region in 1919 was 118 acres of land, of which 50 acres were improved and 36 acres in crops. The average acres of crops per farm ranged from 54 acres in the sugar cane district and 41 acres in the rice district to 16 acres in the citrus fruit district of southern Florida. The fruit and truck farms have usually only 5 to 15 acres in crops, whereas the rice farms average about 100 acres. However, the value of the crops per farm in the citrus fruit district ($2,360) was almost as great in 1919 as in the rice district ($2,775). The cattle ranches are often several thousand acres in size and consist very largely of woodland or marshland pasture. They have frequently a thousand or more cattle.

It is significant that the average area of crop land per farm in the region increased five acres between 1910 and 1920, or one-sixth. There was a similar increase the previous decade. It appears that the farmers are clearing on the average about five acres of land per decade—a notable amount. Nevertheless, there is enough forest and cut-over land of similar quality to that cleared to last over a century at the present rate of clearing.

A TYPICAL NEGRO HOME IN THE COTTON BELT

FIGURE 54.—The owner of this house, Sam McCall, who is seated before it with his family, is an unusual man. Born a slave, after gaining his freedom he worked as a tenant on the plantation of his former owner until he was able to purchase 40 acres of land. Later he increased his holdings to 163 acres. But the land was so eroded, owing to careless cultivation in former times, that only a small portion was tillable, and even this tillable land was sorely depleted of its fertility. After 15 years of effort on the large acreage, McCall decided to concentrate his labor on the best two acres. These produced about a third of a bale per acre at the beginning of his experiment, which is about the average for the Cotton Belt. After ten years these two acres were made to yield 3½ bales per acre, without any artificial fertilizer. In 1908 the harvest from one acre consisted of 75 bushels of oats in May and three bales of cotton in the autumn, while the other acre produced 50 bushels of oats, 50 bushels of corn and a bale of cotton. The rotations and methods of cultivation and seed selection he used are described in Farmers' Bulletin 519, by M. A. Crosby, who took the photograph.

FARM TENURE

Only 27 per cent of the farms in the Subtropical Crops Belt are operated by tenants, a smaller proportion than in any other eastern region, except the Hay and Dairying Belt to the north. On the poorer soils the proportion of farmers who are tenants falls below 10 per cent (Fig. 31). This is in sharp contrast to the adjacent Cotton Belt where 60 per cent of the farms are operated by tenants. Neither vegetable production, in which the risk from frost or overproduction is great, nor fruit growing, in which a tenant can do more injury in a year than the owner can repair in many years, nor sugar cane nor rice production, which require large investments, nor livestock ranching with its vast areas of land, are well adapted to tenant operation; whereas cotton is peculiarly suited to production by tenants. Several of the systems of farming in the region, however, are well suited to operation by managers, the proportion of farms operated by managers (2.5 per cent) being higher than in any other eastern region.

THE PEOPLE

The rural population outside the sugar-cane district is much sparser in this region than in the Cotton Belt, and, in general, whites greatly exceed negroes in number. In the sugar cane sub-region the population is dense, and the negro almost equals the white population in number. As in the Cotton Belt, the population is practically all native born, except that there are a considerable number of Italians in the sugar cane sub-region. These Italians, however, are engaged mostly in truck gardening, and represent a group that is more or less distinct. It

should be recalled that the sugar-cane district was originally settled by the French, and in some of the parishes in this sub-region French is still the common speech of the people.

The farm population has increased rapidly in the eastern portion of the Subtropical Crops Region, owing largely to the development of the trucking and fruit-growing industries made possible by the use of fertilizer. In the sugar cane section the population is decreasing, the average number of people per farm decreasing more rapidly than the number of farms. Farm population in the rice district is about stationary. Nevertheless, taken as a whole, the rate of increase of farm population in the Subtropical Crops Region is more rapid than in the other agricultural regions in the United States, except the Spring Wheat Region and Pacific Coast regions.

Many people in this Subtropical Crops Region are illiterate, about 7 per cent of the whites and 25 per cent of the negroes. The percentage of illiteracy is not as great as in the Cotton Belt, and as educational conditions are improving rapidly, with the increase in population and wealth, it appears not unlikely that in the course of another generation the region will approach the educational standards of the northern and western states.

THE COTTON BELT

This region includes that portion of the southeastern United States in which cotton is the leading crop based on value. It comprises eastern North Carolina, except the Coastal portion, and nearly all of South Carolina, Georgia, Alabama, and Mississippi; the southwestern corner of Tennessee, the southeastern tip of Missouri, Arkansas south and east of the Ozarks, northern Louisiana, most of Texas, and the southern half of Oklahoma (see Fig. 13). The Cotton Belt is about 1,600 miles long and varies from 125 to 500 miles wide, the average width being about 300 miles. Its area is 295,000,000 acres, or nearly one-sixth of the entire area of the continental United States; and in it were produced in 1919 crops valued at nearly 3,800,000,000 dollars, which is one-fourth the total value for the United States. There are 2,100,000 farms in the Cotton Belt, or nearly one-third of the farms, as defined by the census, in the United States. It will be noted that there are twice as many farms per unit of area in the Cotton Belt as in the remainder of the United States.

In this region, which constitutes less than 3 per cent of the land area of the world, about 60 per cent of the world's cotton is grown. Corn is the other principal crop, the acreage in corn being nearly three-fourths that in cotton, but the value in 1919 was only one-third as great. These two crops constitute nearly three-fourths of the acreage and over two-thirds of the value of all crops. There is little pasture, except in the western prairie and plains portion. The forests of the Cotton Belt, however, have been the principal source of the nation's lumber and turpentine for more than a quarter century, and a considerable part of the income of the people has come from lumbering operations.

THE PHYSICAL CONDITIONS

The boundaries of the Cotton Belt are almost wholly determined by climate, but the density of cotton production within the region is very largely dependent on the soils.

Boundaries

The northern boundary of the Cotton Belt is drawn where cotton becomes the leading crop based on value. This northern boundary, which closely follows the line of 200-day average frost-free season, and of 77° F. average summer temperature, is remarkably distinct along most of its length (Figs. 13 and 55). The proportion of crop land in cotton along this boundary increases from practically nothing to 20 and 30 per cent within the width, usually, of a county. Owing to the spread of the boll weevil and the high price of cotton, this northern border has been pushed north in recent years

from 20 miles in the eastern portion to 100 miles in northwestern Texas. The western boundary, beyond which the pasturage exceeds the value of crops, may be drawn at present through Portales, New Mexico, and a little to the west of Lubbock, San Angelo, Uvalde, and Brownsville, Texas. This western boundary is mainly a moisture line, the average annual precipitation increasing from 17 to 18 inches at the north to 21 inches at the south. This western border is probably permanent, but it is only a line of outposts at present with vast areas back of it available for cotton production.

consequently the boundary of the Cotton Belt has retreated in recent years from ten to forty miles farther inland along this southern margin.

From Charleston, S. C., to Norfolk, Va., the Cotton Belt formerly extended to the Atlantic Ocean, except that around Wilmington, N. C., vegetables were a more important crop than cotton. But the 1925 census shows that in all the counties bordering the coast tobacco, peanuts, or truck crops have now a greater value than cotton. In the eastern Carolinas, the average annual precipitation rises to 55 inches and the autumn rainfall exceeds 10 inches (Fig. 56). Under

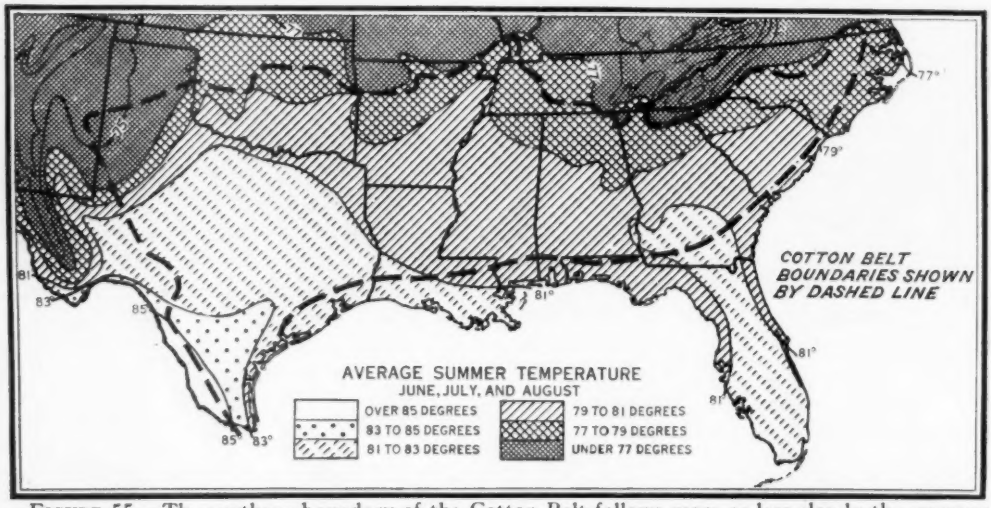


FIGURE 55.—The northern boundary of the Cotton Belt follows more or less closely the summer temperature of 77 degrees; except that cotton is not grown so far north in central Tennessee and northern Oklahoma, as the temperature line would indicate as feasible, while on the Staked Plains of Texas, where it is free from the boll weevil and modern machinery is used, cotton has advanced into territory where the summer temperature is as low as 75 degrees. (Adapted from Map in Cotton Section, Atlas of American Agriculture, U. S. Dept. of Agriculture.)

The southern boundary which, like the northern, is drawn where cotton ceases to be the leading crop, is approximately the line of 10 inches autumn rainfall. This follows the Gulf and South Atlantic coast from Matagorda Bay, Texas, to Charleston, S. C., at a distance usually of from thirty to seventy miles inland (Figs. 40 and 56). Along this coast the heavy autumn rainfall interferes with the picking, and damages and discolors the lint. The boll weevil is also very injurious in this moist, mild climate; these humid conditions cotton picking is more difficult than inland and the crop is greatly injured by the boll weevil. Consequently, as the demand for tobacco and early vegetables has increased with the increase of population in the northern cities and improved transportation facilities, cotton has yielded its dominant position in this coastal belt to these other crops which are also favored by the mild temperatures but helped rather than hindered by the high rainfall.

Climate

A very little cotton is grown for household use by the mountaineers in eastern Kentucky, where the summer temperature is only 74 degrees, but the northern boundary of commercial production still remains at about 77 degrees, except in northwestern Texas where considerable

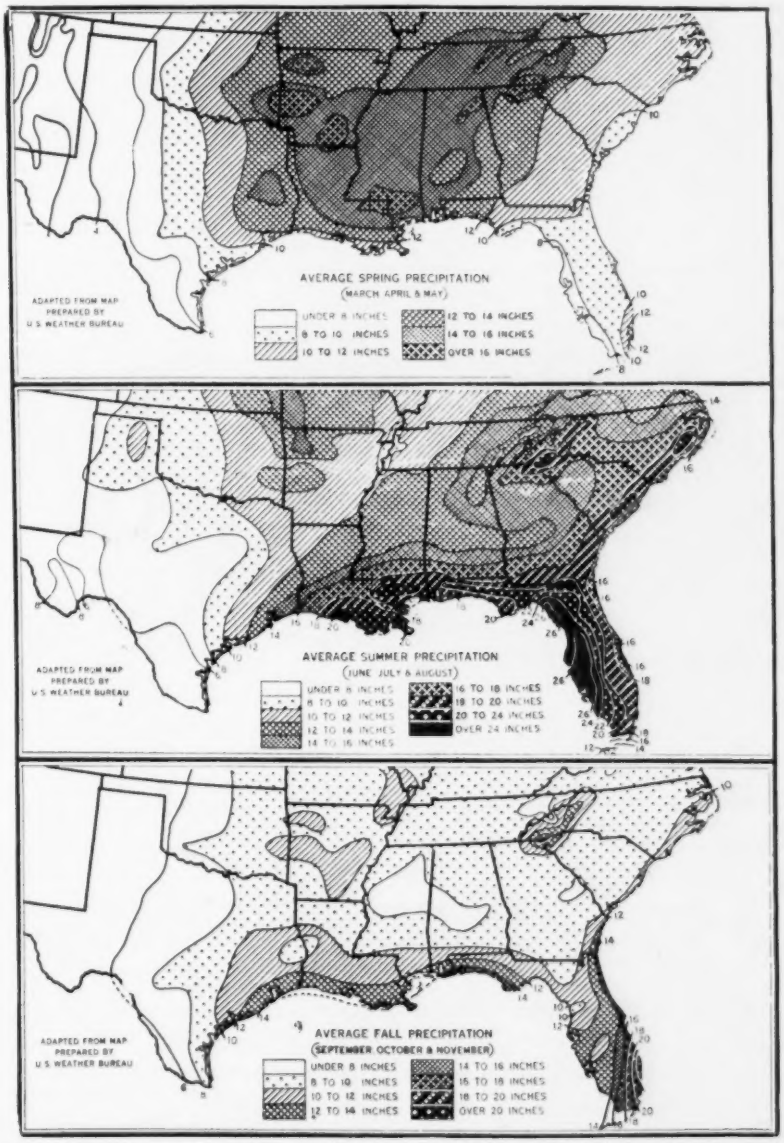

AVERAGE SPRING PRECIPITATION
(MARCH APRIL & MAY)
ADAPTED FROM MAP PREPARED BY U.S. WEATHER BUREAU
UNDER 8 INCHES
8 TO 10 INCHES
10 TO 12 INCHES
12 TO 14 INCHES
14 TO 16 INCHES
OVER 16 INCHES
AVERAGE SUMMER PRECIPITATION
(JUNE JULY & AUGUST)
ADAPTED FROM MAP PREPARED BY U.S. WEATHER BUREAU
UNDER 8 INCHES
8 TO 10 INCHES
10 TO 12 INCHES
12 TO 14 INCHES
14 TO 16 INCHES
16 TO 18 INCHES
18 TO 20 INCHES
20 TO 24 INCHES
OVER 24 INCHES
AVERAGE FALL PRECIPITATION
(SEPTEMBER OCTOBER & NOVEMBER)
ADAPTED FROM MAP PREPARED BY U.S. WEATHER BUREAU
UNDER 8 INCHES
8 TO 10 INCHES
10 TO 12 INCHES
12 TO 14 INCHES
14 TO 16 INCHES
16 TO 18 INCHES
18 TO 20 INCHES
OVER 20 INCHES

FIGURE 56.—In spring the heaviest rainfall (over 12 inches, or 4 inches a month on the average) occurs in the central portion of the Cotton Belt, and is likely to cause shallow rooting. The spring rainfall in the Staked Plains of Texas, on the other hand, averages only 4 to 6 inches (or less than 2 inches per month), which often delays the growth of the cotton so that it is severely injured by frost in the fall. The summer rainfall is heaviest along the Eastern Gulf and South Atlantic Coast. In Louisiana it has been found that the higher the August rainfall the lower the yield of cotton. Probably this is partly because of the greater activity of the boll weevil in wet seasons. Autumn is the driest season throughout the Cotton Belt, the average rainfall exceeding 10 inches only along the Gulf and Atlantic Coasts, in Florida, and in portions of Arkansas. Frequent rain at this season of the year not only interferes with picking and damages the lint, but also favors destruction of the bolls by the weevil. (Maps from Cotton Section, Atlas of American Agriculture.)

quantities are being grown at present where the average summer temperature is only 75 degrees. In the southern portion of the Cotton Belt the summer temperature is 80 to 85 degrees, and in the Imperial Valley of California the average approaches 95 degrees. Along the northern margin of the Cotton Belt the last killing frost in spring occurs, on the average, about April 10, and the first killing frost in fall about October 25, so that the frostless season is about 200 days. In the southern portion of the Cotton Belt the frostless season is 260 days or more in length (Fig. 4).

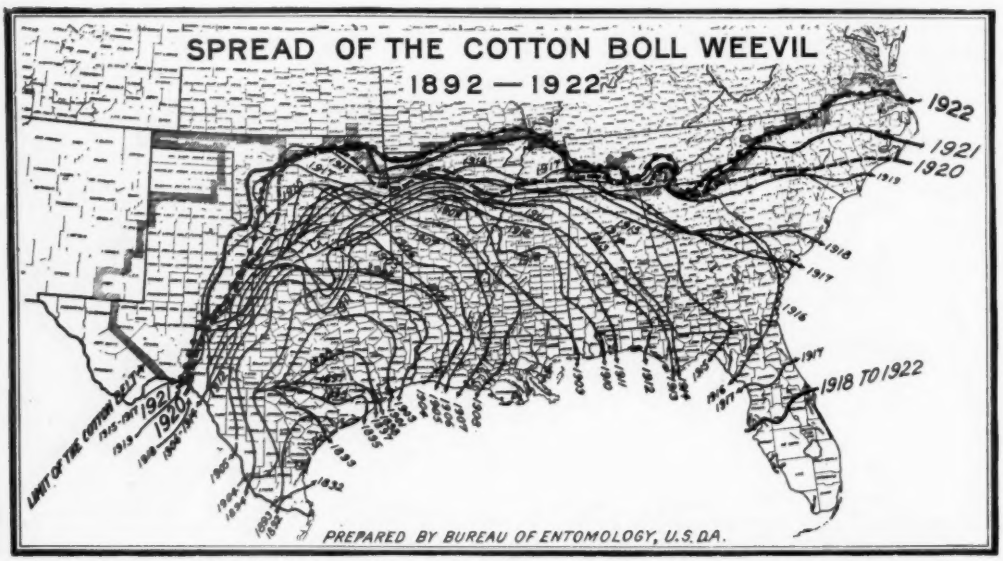
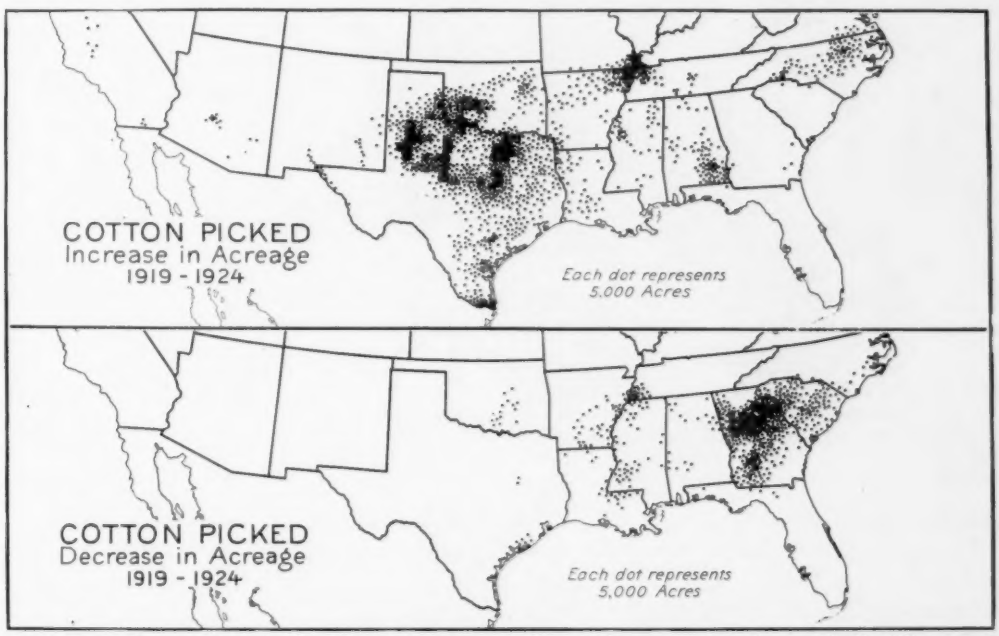


FIGURE 57.—In 1892 the boll weevil crossed the Rio Grande from Mexico and occupied a small area in the extreme southern tip of Texas. Note this area, indicated by the short line and the figures 1892. By 1922, thirty years later, the boll weevil had spread into practically every part of the Cotton Belt, except western Texas and adjacent counties of Oklahoma. On the Texas plains the dry, cold winters, save for an occasional temporary infestation, keep it back of a line running from Del Rio, Texas, to Altus and Enid, Oklahoma. Despite the boll weevil the Cotton Belt produced in 1926 the largest crop in its history.

The average annual precipitation in the Cotton Belt ranges from 18 inches in western Texas to 55 inches in eastern North Carolina and 60 inches in southern Mississippi, but throughout much of the Belt is between 30 and 50 inches (Fig. 3). The spring rainfall ranges from 6 inches in western Texas to 16 inches in Arkansas and southern Mississippi, being heavier in the Mississippi Valley States than in Texas or the South Atlantic States (Fig. 56). The summer rainfall is somewhat greater than that of the other seasons, especially in the southern and eastern portion of the Belt, reaching a maximum of 20 inches in southern Mississippi and in eastern North and South Carolina; while in the Black Prairie of Texas and the Panhandle the amount received averages only 8 inches. Autumn is the driest season of the year, nearly all the important cotton districts, as already noted, receiving less than 10 inches of rain during the fall months. October and November, when the picking season is at its height, are the driest months throughout practically the entire Cotton Belt.

The best weather conditions for cotton production are found where a mild spring with light but frequent showers merges into a moderately moist summer, warm both day and night, followed by a dry, cool, and prolonged autumn. Too cool weather in the spring retards growth, and too much rain may induce the seed to rot rather than germinate, or later cause the

development of surface roots to the sacrifice of the deeper roots, with resultant wilting and shedding of leaves and bolls during drought in summer. May and June particularly are critical months when heavy rainfall, especially if accompanied by low temperatures, is very detrimental. Rainy weather in these months also interferes with cultivation. On the other hand, drought in the spring and early summer often kills the young shallow-rooted seedlings. A wet summer promotes vegetative growth, or "weed," at the expense of boll production, and favors the growth of weeds, while drought stunts the plants, causes early maturity, and reduces the yield, as does also a spell of cool weather. The most unfavorable conditions for the crop are a cool and wet May and June followed by a hot and dry July and August. The ideal rainfall is of the thunder-shower type with several days of bright, warm weather between rains. Plenty of sunshine is especially important in June and early July when the plants are in bloom. As the cotton matures and the bolls begin to open, in the latter part of August, rainy weather is undesirable, as it retards maturity, interferes with picking, and discolors or damages the exposed fiber. Moderate rain in early September, however, favors the production of a large "top crop" of late maturing bolls. The greater daily range in temperature in a dry fall is also favorable to the maturing crop as it checks vegetative growth and induces fruiting. Early frost in the fall kills the "top crop" on the upper branches of the plant, or causes the bolls to open prematurely, often seriously reducing the yield. In northern Texas and Oklahoma, where



FIGURES 58 AND 59.—The inroads of the boll weevil, and the migration of over a half million farm people to the North and to the southern cities, attracted by high wages, reduced cotton acreage very greatly in the Eastern Cotton Belt between 1919 and 1924, especially in Georgia and South Carolina. During the same period, owing largely to the relative freedom from the boll weevil and to the use of labor-saving machinery, the western portion of the Cotton Belt, principally Texas and Oklahoma, increased its acreage of cotton by an amount exceeding the decrease in the eastern portion. Since 1924 a notable recovery has occurred in the Eastern Cotton Belt, the acreage in 1926 in the States east of the Mississippi river being 19 per cent greater than in 1924. The increase continued west of the Mississippi being 11 per cent during these two years. (Maps from preliminary report by author, "Changes in Land Utilization, 1919–1924," U. S. Dept. of Agriculture.)

the winds dry out the cotton in the unopened frost-bitten bolls, this "top crop" is "snapped" from the stalks, and, after being run through a machine which removes the burrs, is ginned and sold as "bollies." In other sections rains may cause the frost-bitten bolls to rot.[4]

The trend in recent years has been toward the production of more cotton in the drier western portion of the Cotton Belt, and along the cooler northern margin, where the infestation of the boll weevil is less severe or entirely absent (Figs. 57, 58, and 59). The profitable production of cotton in these marginal areas is made possible by the higher price in recent years (83 per cent increase in 1922–1924 in purchasing power over that of 1909–1914).

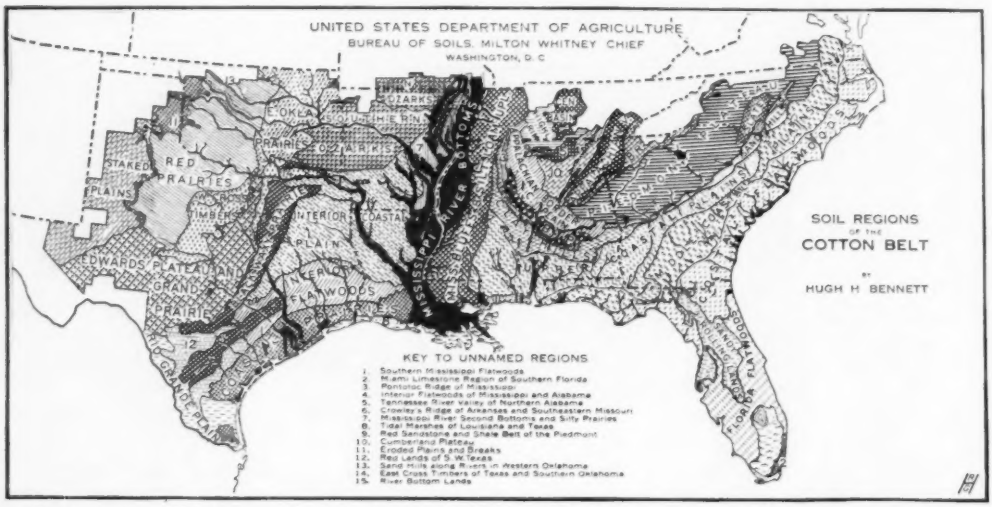

UNITED STATES DEPARTMENT OF AGRICULTURE
BUREAU OF SOILS, MILTON WHITNEY CHIEF
WASHINGTON, D. C
SOIL REGIONS
OF THE
COTTON BELT
BY
HUGH H. BENNETT
KEY TO UNNAMED REGIONS
1. Southern Mississippi Flatwoods
2. Miami Limestone Region of Southern Florida
3. Pontotoc Ridge of Mississippi
4. Interior Flatwoods of Mississippi and Alabama
5. Tennessee River Valley of Northern Alabama
6. Crowley's Ridge of Arkansas and Southeastern Missouri
7. Mississippi River Second Bottoms and Silty Prairies
8. Tidal Marshes of Louisiana and Texas
9. Red Sandstone and Shale Belt of the Piedmont
10. Cumberland Plateau
11. Eroded Plains and Breaks
12. Red Lands of S. W. Texas
13. Sand Hills along Rivers in Western Oklahoma
14. East Cross Timbers of Texas and Southern Oklahoma
15. River Bottom Lands

FIGURE 60.—This map of Soil Regions includes both the Cotton Belt and the Humid Subtropical Crops Belt. Practically all the sub-regions shown are recognized by local residents, and many of them are known by the same names as are given on the map. See the text for a brief description of each sub-region.

Surface of the Land, or Topography

About two-thirds of the Cotton Belt consists of a broad coastal plain composed principally of sedimentary material, bordering and largely derived from two ancient and much eroded mountain masses, the Appalachian Highland (including the Piedmont) in the East and the Ozark Highlands in the West (Fig. 60). From these highland areas rivers radiate across the coastal plain, bordered, especially along their lower courses, by swampy flood plains often several miles in width; and in the broad depression between these two highlands the Mississippi River flows southward, dividing the Cotton Belt into an eastern and a western section approximately equal in area, in acreage of improved land, and, until recently, in production of cotton. Beyond the boundary of the coastal plain the Cotton Belt includes northern and western marginal areas, comprising a portion of the Piedmont Plateau and of the valleys associated with the Cumberland Plateau and the Blue Ridge Mountains in the East, together with the valleys of the Southern Ozarks (Ouachita and Boston Mountains) and a large portion of the prairies and plains of Texas and Oklahoma in the West.

The surface of the land is level to gently rolling on the eastern and southern margin of the Cotton Belt, somewhat more uneven inland, and is distinctly hilly in the vicinity of the Blue Ridge, Cumberland, and Ouachita Mountains. On the plains of central and western Texas and

[4] From the Cotton Section of the Atlas of American Agriculture (by the author).

Oklahoma the land is almost level. The elevation ranges from sea level in the east to over 4,000 feet in northwestern Texas, but only a small portion lies above 1,000 feet altitude.

Soils

The boundaries of the Cotton Belt are wholly climatic, but within these boundaries density of production is determined almost entirely by the surface of the land, already noted, and by the soils. The soils outside of the sub-regions listed above are mostly loams and sandy loams, often with a clay subsoil and of relatively low productivity, being derived largely from Coastal Plain deposits and subject to centuries of leaching by winter rains. These soils can be made productive, however, by the use of fertilizers, and owing to their loamy texture are easily cultivated. Cotton is grown on practically all well-drained types of soil in the Cotton

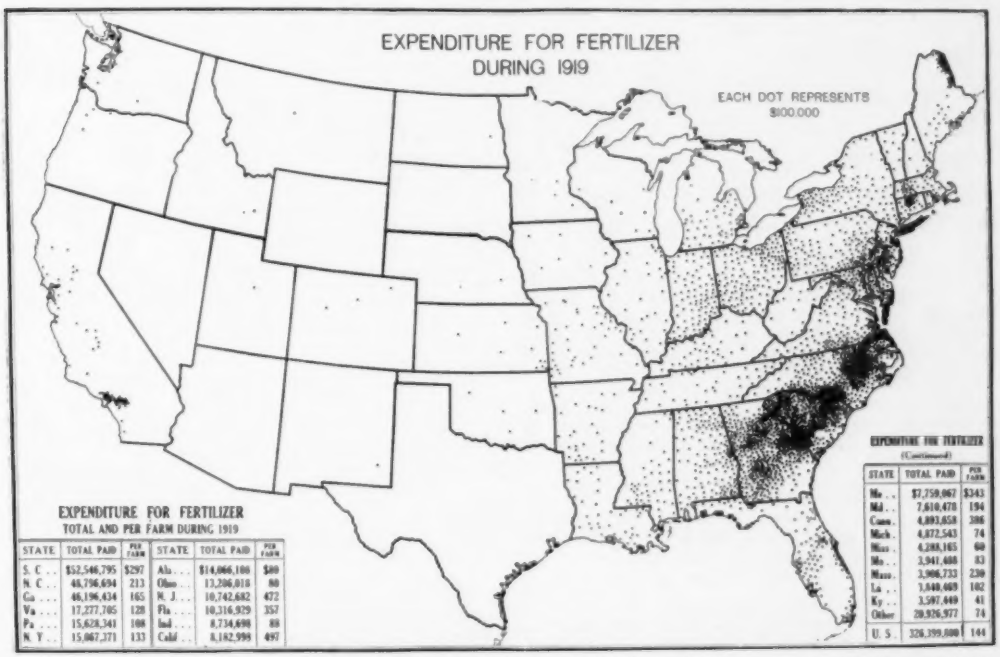

EXPENDITURE FOR FERTILIZER
DURING 1919
EACH DOT REPRESENTS
$100,000
EXPENDITURE FOR FERTILIZER
TOTAL AND PER FARM DURING 1919
STATE | TOTAL PAID | PER FARM | STATE | TOTAL PAID | PER FARM
S. C. | $52,546,795 | $297 | Ala. | $14,066,108 | $89
N. C. | 48,796,694 | 213 | Ohio | 13,206,018 | 80
Ga. | 46,196,434 | 165 | N. J. | 10,742,682 | 472
Va. | 17,277,705 | 128 | Fla. | 10,316,929 | 357
Pa. | 15,628,341 | 108 | Ind. | 8,734,698 | 88
N. Y. | 15,067,371 | 133 | Calif. | 8,182,998 | 497
EXPENDITURE FOR FERTILIZER
(Continued)
STATE | TOTAL PAID | PER FARM
Me. | $7,759,067 | $343
Md. | 7,610,478 | 194
Conn. | 4,893,658 | 386
Mich. | 4,872,543 | 74
Miss. | 4,288,165 | 60
Mo. | 3,941,488 | 83
Mass. | 3,906,733 | 230
La. | 3,840,469 | 102
Ky. | 3,597,449 | 41
Other | 20,926,977 | 74
U. S. | 326,399,880 | 144

FIGURE 61.—The Eastern Cotton Belt, notably the Middle and Upper Coastal Plain and the Piedmont sub-regions in Georgia and the Carolinas, use more fertilizer than any other portion of the United States; indeed, these three States expended for fertilizer in 1919 almost as much as all other states combined. (Map from 1921 Yearbook, U. S. Dept. of Agriculture.)

The sub-regions of denser production are districts of more fertile soils—the Piedmont Plateau and Upper Coastal Plain (which are separated by the less fertile belt of Sand Hills), the Black Prairie of Alabama and Mississippi, the Yazoo-Mississippi Delta, the Red River Valley and, most important of all, the Black Waxy Prairies of Texas. Other centers are now developing on the Red Prairies and the Staked Plains. In the first two sub-regions the use of fertilizers has greatly increased the productivity of Belt, but, in general, the yield on unfertilized sandy upland soils is small, and in wet seasons also the heavy clays and some bottom-land soils give low yields, although producing large vegetative growth.

The following summary description of the sub-regions of the Cotton Belt and adjacent territory based on the character of the soil (see Fig. 60) is taken mostly from the Cotton Section of the Atlas of American Agriculture. The yields per acre given are averages for the years

1879, 1889, 1899, and 1909, unless otherwise noted. These yields are better criteria of the differences in the fertility of the land than acre yields based on more recent census reports, which would be seriously affected by the movement northward and eastward of the boll weevil infestation. Likewise, it is believed that the figures of production of the various districts, which are averages for the five years, 1911–1915, except for the western sub-regions, are more representative, both of the past and of the future, than present-day production averages would be.

IMPORTANT SUB-REGIONS OF THE COASTAL PLAIN

The following brief descriptions should be read in connection with Figure 60, for which they will serve as a legend.[5]

Atlantic Coast Flatwoods

This sub-region extends along the coast of the Carolinas and Georgia into Florida. Area, 21,200,000 acres. Elevation, 0 to 150 feet. Surface, flat to undulating; much poorly drained land and swamp. Soils, mainly dark and grayish sands and sandy loams, with yellow, gray, and mottled sand and clay subsoils; considerable silt loam in northeastern North Carolina. Vegetation, principally open forests of long-leaf pine, with gall berry and grassy undergrowth. Fertilizers are extensively used. Average yield per acre of lint cotton was about 200 pounds; average production, 290,000 bales.

The 1925 census shows that the truck crops or tobacco have replaced cotton as the leading crop in value in most of this sub-region. As this shift is probably permanent the southern portion of the Flatwoods is now included in the Subtropical Crops Belt and nearly all the northern portion in the Atlantic Trucking and Tobacco Region.

Florida and Southern Mississippi Flatwoods

Area, 15,000,000 acres. Mainly dark and grayish to white, deep sandy soils. Vegetation, chiefly long-leaf pine, with saw palmetto undergrowth. Little cotton is grown in this sub-region, which is practically all included in the Subtropical Crops Region.

Middle Coastal Plain

This sub-region extends across the Carolinas and Georgia into western Florida. Area, 20,600,000 acres. Elevation, mostly between 100 and 400 feet. Surface, gently rolling. Soils, mainly grayish sandy loams with yellow, friable, sandy clay subsoils. Vegetation, long-leaf pine and wire grass. Yield of cotton per acre, about 205 pounds; production, 1,140,000 bales, owing largely to the use of fertilizer. The boll weevil has now made cotton production generally unprofitable in the southern (Florida) portion of this sub-region.

Upper Coastal Plain

This sub-region extends from South Carolina across central Georgia and southern Alabama into central Mississippi, and includes a portion of northern Florida. Area, 28,700,000 acres. Elevation, 20 to 500 feet. Surface, rolling. Soils, mainly grayish and reddish sandy loams with yellow and red, friable, sandy clay sub-soils. Vegetation, long-leaf and short-leaf pine, some oak and hickory. Yield of cotton per acre, about 190 pounds; production 1,130,000 bales. Much fertilizer is used.

Clay Hills

This sub-region extends from western Georgia through Alabama and Mississippi almost to the Tennessee line. Area, 8,000,000 acres. The soils have stiff clay subsoils, and the surface is hilly, including some rough, stony land known as "white rock land" in east-central Mississippi and western Alabama. Average yield of cotton per acre, about 145 pounds; average production, 320,000 bales.

Sand Hills

This sub-region extends in a narrow interrupted belt along the upper margin of the Coastal Plain from central North Carolina across South Carolina and Georgia into Alabama. Area, 3,400,000 acres. Soil, prevailingly deep, loose sand, grayish at the surface and yellowish beneath. Vegetation, long-leaf pine and forked leaf blackjack oak. Fertilizer is extensively used. Average yield of cotton per acre is about 180 pounds; average production, 175,000 bales.

Black Prairies

This crescent-shaped belt extends from eastern Alabama into northeastern Mississippi. Area, 4,000,000 acres. Elevation, 200 to 500 feet. Surface, gently rolling with some flat "post oak land." Soils, mainly dark gray and brown, limey clays. The included "post oak" soils are brown, sandy loams and clays, with reddish subsoils and contain less lime. Yield of cotton per acre is less than 150 pounds, owing largely to continuous cropping and shallow plowing, also to the heavy soils causing late maturity of the cotton, with greater injury by the boll weevil as a consequence. Average production, 235,000 bales.

Mississippi Bluffs and Silt Loam Uplands

This sub-region borders the Mississippi bottom lands on the east, and extends from Louisiana into Kentucky. Area, 16,800,000 acres. Elevation, 100 to 600 feet. Surface, level to undulating, badly gullied in places. Soils, mainly brown silt loams of loessal origin, becoming thinner along the eastern border. A narrow strip of similar soil occupies Crowley's Ridge, extending from southeastern Missouri to Mariana, Arkansas. Vegetation, principally oak, sweet gum, and poplar. Yield of cotton per acre about 200 pounds; production, 586,000 bales.

Interior Flatwoods

The largest area of the Interior Flatwoods extends from the Mississippi bottoms in Louisiana to the Guadalupe River in Texas. A long, narrow, crescent-shaped belt extending from central Alabama into northeastern Mississippi has similar soils and topography. Area, 13,000,000 acres, including about 600,000 acres in Alabama and Mississippi. Elevation, 100 to 500 feet. Surface, prevailingly flat; much poorly drained land. Soils, mainly gray, sandy loams, silt loams, and clays with compact gray and yellow or mottled subsoils. Vegetation, long-leaf pine in Louisiana and eastern Texas, post oak in central Texas, Alabama, and Mississippi. Yield of cotton per acre, about 175 pounds; production, 366,000 bales.

Interior Coastal Plain

This sub-region comprises a large area of prevailingly rolling country in northeast Texas, northwest Louisiana, and southwest Arkansas. Area, 28,800,000 acres. Elevation, 100 to 500 feet. Vegetation, in the east, long-leaf and short-leaf pine and some oak; in the west, oak with some prairie areas. Soils, mainly grayish, brownish, or reddish, sandy loams, sands and clays having, in area A, much soil with yellow, red, and mottled, friable subsoils, and in area B, relatively more soil with gray and red, mottled, stiff clay subsoils. Section A produces an average of about 165 pounds of cotton per acre, and section B 163 pounds. The total production averages 995,000 bales.

"Black Waxy" Prairies

There are two main bodies of these prairies, one extending from the Red River in northeast Texas to San Antonio,

[5] The description of the soils, and to a less extent of the vegetation, is condensed from H. H. Bennett, "The Soils and Agriculture of the Southern States." This book and Hilgard's Report in the 1880 Census afford the best descriptions of physical conditions in the South.

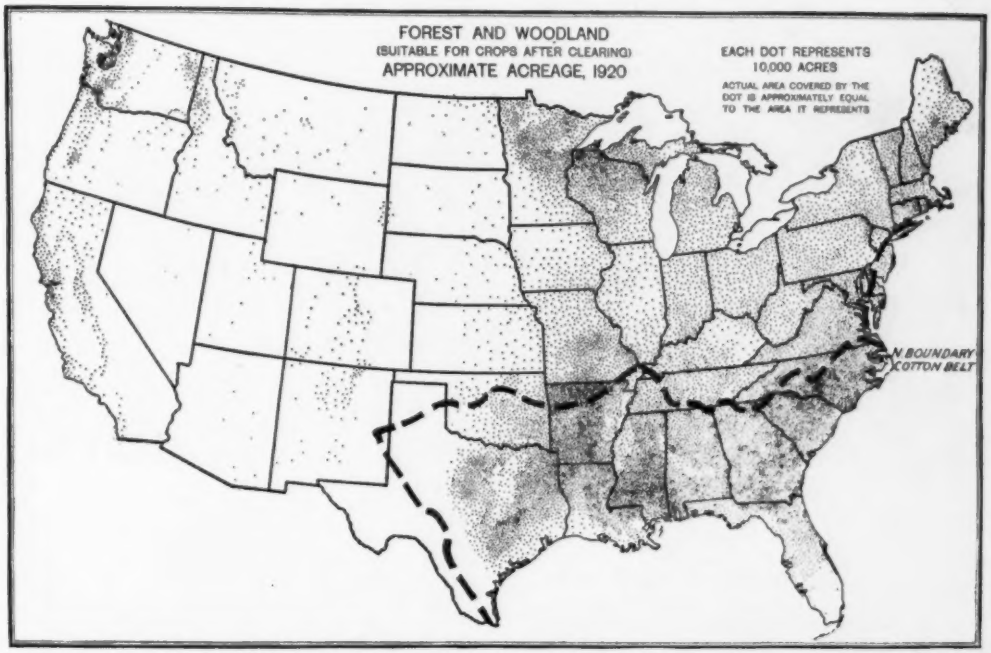


FIGURE 62.—The South possesses about as large an acreage of forest and cut-over land suitable for crops after clearing as that in all other parts of the United States; and, despite the severity of the agricultural depression, the acreage of such land that was cleared and made suitable for crops between 1919 and 1924, over 2,000,000 acres, was greater in the South than in the remaining portions of the United States. However, there is enough forest and cut-over land available for crops in the South (about 110,000,000 acres) to require over 250 years for clearing at the rate of progress during this five-year period. But if clearing progressed as rapidly as between 1880 and 1920, it would require only about 125 years. The South constitutes the great reservoir of potential agricultural land in the United States. (Map from 1921 Yearbook, U. S. Dept. of Agriculture.)

and the other from the Brazos River nearly to Laredo. Area of the first about 8,400,000 acres, of the second about 4,900,000 acres. Elevation, 100 to 600 feet. Surface, flat to undulating; drainage, good. Soils, black and dark gray, calcareous clays. There is a small belt of similar soils in southeastern Oklahoma and southwestern Arkansas. Average yield of cotton per acre about 175 pounds; average production, 1,320,000 bales.

Less important soil sub-regions of the Coastal Plain are the *Sandy Rolling Lands of Interior Florida* (now wholly included in the Subtropical Crops Belt), which contains some red and brown, loamy hammock lands, where Sea Island cotton was formerly grown; the *Appalachian Border of the Coastal Plain* in northern Alabama and northeastern Mississippi, a region of rolling to hilly, grayish sandy loams with yellow and red subsoils, supporting mixed pine and oak forest; the *Pontotoc Ridge*, in Mississippi, which has soils similar to those of the Upper Coastal Plain; and the *Gulf Coastal Prairies* of Louisiana and Texas, which is a flat, imperfectly drained region of black, brown, and gray clays and loams with black, yellow, and gray mottled clay subsoils, limey in the western portion. The eastern portion of the Coastal Prairies is largely devoted to rice and the western portion principally to grazing and to corn growing, with cotton ranking second in importance. The semi-arid *Red Lands of Southwest Texas* are being used to an increasing extent for cotton production. The soils are mainly reddish sandy loams, gravelly loams, and loams with red subsoils.

ALLUVIAL LAND SUBREGIONS

Alluvial soils occupy a larger area in the Cotton Belt and Subtropical Crops Belt than in any other region in North America.

Alluvial Bottoms of the Mississippi and Other Rivers

This sub-region includes as the principal area the flood plains of the Mississippi River from Cape Girardeau, Missouri, to the Gulf. It also includes the bottoms of all other rivers within the Cotton Belt, many of which are too small to show on the map. Much of the land is subject to overflow, requiring protection by levees. Area, about 16,500,000 acres. Elevation, 0 to 300 feet. Surface, level. Soils of the Mississippi Bottoms, mainly brown or mottled clays, silt loams, and fine sandy loams with gray, light brown, and mottled subsoils. Vegetation, largely cypress, red gum, and oak. Production of cotton about 940,000 bales. The most important cotton-growing section in this region is that known as the Yazoo Delta, in which the average yield of cotton per acre is about 265 pounds, the highest in the Cotton Belt. In the bottoms of the streams east of the Mississippi River the principal soils are brownish loams, silt loams, and fine sandy loams, with yellowish and mottled subsoils; west of the Mississippi the principal soils are chocolate-red, brown, and black loams, silt loams, and clays, usually calcareous.

Mississippi River Second Bottoms and Silty Prairies

These second bottoms are extensively developed in southeastern Missouri and northeastern Arkansas. They lie above overflow. The important soils are brown and gray silt loams, and fine sandy loams with light brown, gray, and mottled subsoils. The gray soils are poorly drained. The better drained soils are extensively used for cotton, giving good yields.

DUSTING A COTTON FIELD WITH CALCIUM SULPHATE

FIGURE 63.—The picture, taken near Tallulah, Louisiana, shows one of the simpler machines used for this purpose. The cost of the poison and its application is such that it becomes profitable normally only when the yield exceeds a third of a bale per acre. This is the only satisfactory means yet discovered of controlling the boll weevil, but it should be accompanied by the destruction of all dead cotton stalks and other refuse that may afford protection to the weevils during the winter (see Fig. 64).

IMPORTANT SUB-REGIONS OF THE PIEDMONT, APPALACHIAN, AND OZARK PLATEAUS, MOUNTAINS, AND VALLEYS

These upland sub-regions comprise about one-sixth of the area of the Cotton Belt.

Piedmont Plateau

This sub-region extends from near New York City southwestward to Alabama, but is planted in cotton only from North Carolina southward. Area in the Cotton Belt, 26,700,000 acres. Elevation, 100 to 1,500 feet. Surface, rolling to hilly, often requiring terracing of cultivated slopes to prevent erosion. Soils, red clay loams and grayish sandy loams with red or yellow clay subsoils, derived principally from granite, schist, and diorite. Vegetation, largely oak,

DUSTING A COTTON FIELD BY AIRPLANE

FIGURE 64.—The airplane has been found to be a more rapid and, under favorable conditions, a cheaper means of dusting calcium sulphate on cotton fields than the mule or horse-drawn machines. Several airplane companies organized for this purpose are now operating in the South. The usual charge is five dollars per acre per application. The largest crop of cotton in American history was grown in 1926, and the average yield per acre, 181 pounds, was the highest since 1914. (This picture and the preceding one were supplied by B. R. Coad, Bureau of Entomology, U. S. Dept. of Agriculture.)

short-leaf pine, and hickory. Average yield per acre of cotton, about 180 pounds; average production, 1,860,000 bales. Fertilizer is extensively used.

In the *Carolina State Belt* portion of the Piedmont, the principal soils are gray silt and slate loams and red clay loam, with yellow and red clay subsoils. Fair to good yields of cotton are made, according to fertilization.

Less important sub-regions along the northern margin of the Cotton Belt are the *Appalachian Limestone Valleys*, including the Tennessee River Valley of northern Alabama, and the *Central Basin* in Tennessee. These are regions of fertile, brown, reddish, and gray loams, silt loams, and clay loams with reddish and yellowish subsoils, largely derived from limestone and often cherty. A little cotton is grown in the southern portion of the Highland Rim region, which has gray silty and stony soils; and also in the valleys and smooth uplands of the *Southern Ozarks* of Arkansas and eastern Oklahoma, which is a hilly to mountainous region having brownish or reddish sandy loam soils, often stony, with red, sandy clay subsoils.

Eastern Oklahoma Prairies

This sub-region extends northward from the Red River in south-central Oklahoma, and includes most of the eastern half of the state. In it the growing of corn and hay and the grazing of cattle are about as important as cotton production. Area in Cotton Belt, about 11,000,000 acres. Elevation, 800 to 1,200 feet. Surface, gently rolling, and some rough areas. Soils, mainly brown, black, and reddish loams, clays and stony loams with clay subsoils, often of a clay-pan nature. Vegetation, prairie grasses with occasional areas of post and blackjack oak and red cedar. Yield per acre of cotton in 1909, 182 pounds, in 1919, 184 pounds; average production, 425,000 bales.

Red Prairies

This sub-region extends across western Oklahoma into north-central Texas. It was formerly devoted to grazing, but since 1900 has experienced extensive development in cotton production. Area, 31,700,000 acres. Elevation, 1,000 to 2,000 feet. Surface, undulating to rolling, with many rough eroded areas known as "breaks" along the western margin. Soils, mainly red and brown, fine sandy loams, silt and clay loams, with red and brown clay subsoils, often of a clay-pan nature. Included in this region are small "sandhill" areas (dunes). Yield per acre of cotton in 1909, 105 pounds, in 1919, 236 pounds; average production, 825,000 bales.

The Staked Plains

This sub-region rises above the Red Prairies and includes all of Texas to the westward, together with the small portion of New Mexico that lies in the Cotton Belt. Like the Red Prairies it is still largely devoted to grazing, but recently a large amount of land, especially in the eastern,

"I WISH I WAS IN THE LAND OB COTTON
OLD TIMES DAR ARE NOT FORGOTTEN"

FIGURE 65.—The cotton crop requires, in the aggregate, more labor than any other crop grown in the United States. The picking of the cotton requires more labor than any other operation in its cultivation, and as no successful cotton picker has yet been invented, it has not paid in the "Old South" to introduce improved machinery for planting and cultivating because a large number of people must be kept for picking who would have little to do at other seasons of the year. Owing largely to this lack of a machine for picking cotton, there has been little incentive for progress in the rural portions of the "Old" Cotton Belt, and the farm population has remained denser than in any other agricultural region. The picture shows the type of negro labor characteristic of the plantation areas of the "Old South." Note the bag hung from the picker's waist, and the pickaninnies. (Photo from U. S. Dept. of Agriculture; photographer and location unknown.)

IMPORTANT SUB-REGIONS OF THE WESTERN PRAIRIES AND PLAINS

The frontier of the Cotton Belt has advanced recently from the prairies (long grass) onto the plains (short grass) of Texas and Oklahoma. These prairies and plains include about one-sixth of the area of the Cotton Belt.

moister portion, has been plowed and put into cotton, grain sorghum, and wheat. Area in the Cotton Belt about 12,000,000 acres. Elevation, 2,500 to 4,000 feet. Surface level, except for an almost imperceptible slope to southeast and a few sand dunes and river "breaks." Soils, mainly light brown to chocolate brown silty clay to sandy loams, underlain at 3 to 5 inches by a heavier subsoil having the columnar fracture characteristic of semi-arid and temperate climates; at 18 inches to 30 inches the white limey layer is found, suggesting the depth of normal penetration of the rains. Yield per acre of cotton in 1919 was 210 pounds, production was 66,000 bales. In 1924 the acre yield was 140 pounds and production 291,000 bales.

Edwards Plateau and Grand Prairie

This sub-region extends from central Texas westward to the Rio Grande River, but only the eastern portion is extensively used for the production of cotton. Area of Grand Prairie about 7,400,000 acres; of portion of Edwards Plateau in Cotton Belt about 6,300,000 acres. Elevation of sub-region, 1,000 to 2,000 feet. Surface, rolling to hilly with some level lowlands. Soils, mainly calcareous silt and clay loams, black, brown, gray, and red in color. Vegetation, largely prairie and plains grasses with scattered post oak and cedar; also much live oak and mesquite in Edwards Plateau portion. Average yield per acre of cotton in both portions was about 120 pounds in 1919; production about 400,000 bales in Grand Prairie, and 75,000 to 100,000 bales in Edwards Plateau portion.

Other Sub-Regions

Less important sub-regions are the *East and West Cross Timbers* in north-central Texas. The soils of both regions are mainly brown sandy loams, often stony, with reddish and yellowish subsoils. Vegetation, mostly post and blackjack oak. These regions are used largely for grazing cattle, but produce some cotton.

UTILIZATION OF THE LAND

The Cotton Belt was originally forested, except the prairie areas of Alabama, Mississippi, and Arkansas, and the much larger prairies and plains of central and western Texas and of western Oklahoma (see Fig. 9). Less than half of this timber land has been cleared for crops (Fig. 10). Much land of the same character as that now used for crops still remains in forest, or has been cut over (see Fig. 62). These forest and cut-over lands are being cleared very slowly. Nearly half of the forest and cut-over land is in farms; over half is owned by lumber companies and others, and lies outside farm boundaries. To clear all the 60,000,000 acres of merchantable timber and the 75,000,000 acres of cut-over and brush land would require about 300 years at the present rate of progress. Probably 25,000,000 acres would also require drainage (see Fig. 41).

Although only 60 per cent of this forest and cut-over land would be suitable for crops after clearing (and a portion after drainage also), it is obvious that there is an abundance of land in the Cotton Belt that can be put into cotton if the demand for cotton raises the price sufficiently high. This higher price, however, might tempt other countries to grow more cotton.

There are probably 60 million acres or more of land in the Cotton Belt, or one-fifth of its area, which are suitable only for forest, because of rough topography, low fertility, or difficulty of drainage. Owing to the demand for lumber and other forest products, it will undoubtedly be more profitable to devote also some of the poorer potential crop land to forest instead of to crops, indeed, the area of forest land may not fall greatly below the present acreage during the next quarter century. The protection of the poorer quality cut-over land of the South from fire and the extension of the area of desirable timber trees by natural reproduction or planting, constitute one of the most pressing land utilization problems in the Cotton Belt. As two-fifths of the forest and cut-over land of the United States is in the South, this provision of wood for the future concerns not only the South but is vital to the highest welfare of the nation.

Trend of Land Utilization

About two-thirds of the Cotton Belt was in farms, one-third was improved land, and a little over one-quarter, or 76,000,000 acres was in crops in 1919. Land in farms in the Cotton Belt decreased 10,000,000 acres between 1909 and 1919, whereas improved land increased nearly 6,000,000 acres (see Fig. 7), and land in crops over 12,000,000 acres. A study of the statistics shows that much less forest and cut-over land was included within farms in 1919 than in 1909, and that the large increase of land in crops (nearly 20 per cent) came about half from improved land, mostly pasture, and half from forest or other unimproved land. Over half the increase in improved land and nearly half the increase in crop land occurred in the eastern and western Coastal Plain areas. The price of cotton justified the extensive use of fertilizers

on the less fertile soils of these areas, and even encouraged the clearing of a large amount of cut-over land. Apparently, a larger acreage of forest and cut-over land was cleared during the decade in these areas than in all the remainder of the United States.

Between 1919 and 1924, however, the spread of the boll weevil across the northeastern portion of the Cotton Belt, together with the large wages obtainable in the industries of the North and in southern mill towns, caused thousands of people to leave the farms in the eastern Cotton Belt, with a resultant decrease of over 16 per cent in crop land in this eastern portion and a drop in land values of approximately 32 per cent. During the same years cotton acreage expanded notably in Texas and Oklahoma, particularly in the western prairie and plains portion of these states, where, owing to the dry, cold winters, the boll weevil does little or no damage, and where modern machinery is more extensively used (Fig. 58). In 1925 conditions were much improved throughout the Cotton Belt, that year's crop, which sold at a fair price, being one of the largest in the history of the region; and it appears probable that, owing to the peculiarly favorable climatic conditions for cotton, the crop acreage will resume its normal expansion as the population of the nation and of the world increases. Both acreage and production of cotton in 1926 were the largest ever known. With the use of calcium arsenate to control the boll weevil, especially its application by airplane, which has now been put on a commercial basis (Figs. 63 and 64), it seems almost certain that the United States will retain its dominant position in the production of cotton.[6]

The Crops

Cotton occupies the best land in the Cotton Belt and is the chief source of the farmer's income. The value of the cotton crop in 1919 was equal to the combined value of all other crops. Cotton requires a large amount of labor, and the farm population is denser in the Cotton Belt than in other parts of the United States, except the Appalachian Valleys of Tennessee and Virginia (Figs. 34 and 65).

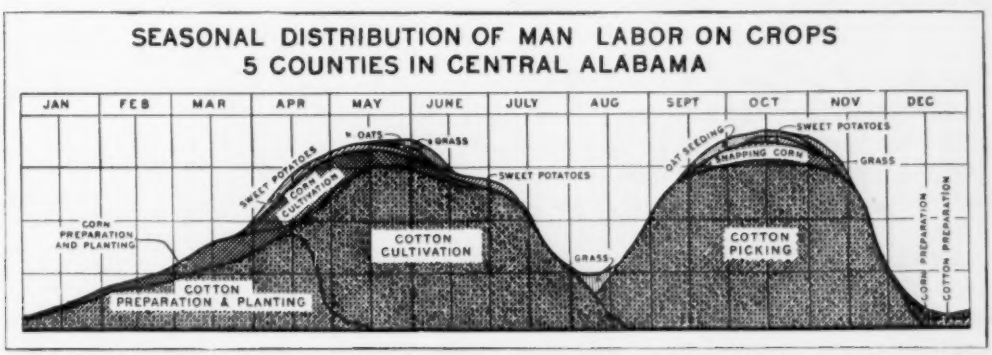


FIGURE 66.—The periods of slack work come in midsummer and in midwinter. No crops are grown on which labor can be utilized during these periods. Unlike the dairy farmer of the North the cotton farmer works only about half the year, and earns perhaps half as much. Some hay making comes in August, but it is unimportant. The picking season is the limiting period for labor on cotton. At the same time, corn should be snapped, oats should be seeded, sweet potatoes dug, and some hay made. It is not surprising, therefore, that where cotton is a profitable crop these other crops may not receive much attention. (Graph prepared by R. R. Spafford, and published in 1921 Yearbook, U. S. Dept. of Agriculture.)

Although cotton requires labor throughout practically the entire season, the distribution of that labor is such that other crops may be cultivated to some extent without reducing the acreage of cotton;

[6] Several companies in Louisiana and Mississippi are now soliciting contracts to dust cotton fields with calcium arsenate by airplane for five dollars an acre — two or three applications are usually required.

consequently, a great diversity of crops for home consumption is produced in the Cotton Belt (Fig. 66). In addition to corn, which in many sections occupies an acreage equal to that in cotton, and is the principal feed and food crop (Fig. 67), oats, wheat, rye, cowpeas, peanuts, sweet potatoes, Irish potatoes, velvet beans, sorghums, garden vegetables, and fruits are produced in considerable quantities in various parts of the Cotton Belt. Some of the vegetables and fruit are grown for sale in northern markets. The peach industry is intensively developed in several counties of Georgia and Texas, while tobacco is an important crop in portions of the Carolinas. Hay is a minor crop, except in Oklahoma and locally in states farther east. The average value of the crops per farm in the Cotton Belt was $655 in 1909 and $1,840 in 1919, in which year the price of cotton was about twice as high as normal.

Livestock

Both cotton and corn require the annual plowing of the land and cultivation during nearly half the growing period, hence the Cotton Belt needs a large amount of animal power per acre. There were nearly 4,600,000 mature horses and mules in the Cotton Belt on January 1, 1920, a larger number than in any other agricultural region, except the Corn Belt (Figs. 68 and 69). Although the work animals in the Cotton Belt are small, they are efficiently utilized, as is shown by the fact that there is no smaller acreage of crops per work animal in the Cotton Belt (16.8) than in the Corn and Winter Wheat Belt (16.6), or the Hay and Dairying Region (16.5). Even the Corn Belt averages less than two acres more crops per work animal (18.6 acres). However, there are, on the average, only two work animals per farm in the Cotton Belt, as compared with three in the Corn and Winter Wheat Belt and five in the Corn Belt. Mules constitute about 60 per cent of the work animals, and horses 40 per cent in the Cotton Belt. Jointly, horses and mules number about 32 per cent of the animal units, but their value is greater than that of all other livestock. The work-stock are imported in large part from the Corn and Winter Wheat Belt to the north (Figs. 70 and 71).

There are more dairy cattle than beef cattle (5,500,000 of all ages as compared with 4,000,000) and jointly they constitute over 50 per cent of the animal units (see Figs. 23 and 24). Over two-thirds of the farms reported dairy cattle in 1919, the average per farm being four. One-sixth of the farms had beef cattle, but the average number per farm reporting was 12. In other words, the dairy cattle are commonly kept largely to supply the farmer's family with milk and butter, whereas the beef cattle are raised by much fewer farmers mostly for market. Although swine constitute only 12 per cent of the animal units, the value of the pork is undoubtedly greater than the value of the beef produced in the Cotton Belt, and is probably equal almost to that of beef and dairy products combined (see Fig. 21). Over three-fourths of the farms had hogs, the average being seven per farm reporting. Nearly all the farms in the Cotton Belt have poultry, 30 to 60 per farm, which are raised almost exclusively for home consumption.

There were about 15,000,000 animal units on farms in the Cotton Belt on January 1, 1919, an average of 34 per square mile, as compared with 94 in the Corn Belt. Both the number of farms having livestock and the number of head per farm is increasing. At the same time, the proportion of the crop land in cotton is decreasing—from 47 per cent in 1909 to 42 per cent in 1919, while acreage in forage crops is increasing correspondingly. Nevertheless, the acreage in cotton is increasing more rapidly than the number of cattle or hogs (Fig. 72).

The Cotton Belt still imports annually, mostly from the Corn Belt, large quantities of meat, principally beef and pork. One of the most serious drawbacks to livestock production in the Cotton Belt, especially in the portion east of Texas and Oklahoma, has been the difficulty of

securing good pastures. In 1924 there were about 15 million acres of plowable pasture in the Cotton Belt, nearly half of which was in Texas. The average plowable pasture per farm was about 15 acres in Texas and Oklahoma, but less than five acres in the states to the east, a very small amount. In both the eastern and western portions of the Cotton Belt the wild grasses growing in the woodlands are relied on for pasture. Over 26 million acres of such woodland pasture in farms was reported in 1924, and probably a large acreage of forest not in farms was used for pasture.

These woodland pastures have been improved greatly in many districts in recent years by the introduction and spread of carpet grass and lespedeza, especially, and both Bermuda grass and Johnson grass have been found to afford, with proper attention, excellent permanent pastures. The acreage of improved pasture more than doubled in the eastern Cotton Belt between 1910 and 1925 and the prospect is bright for the continued rapid expansion of improved pasturage in the South.

In the Cotton Belt about 52 per cent of the crop land in 1919 was devoted to the production of feed for livestock, mostly corn, cowpeas, velvet beans, and peanuts, about 38 per cent to cotton, tobacco, and other crops not used as feed for livestock or food for man, except incidentally, and less than 10 per cent to produce food consumed directly by man.[7] Corn is used for both feed and food in this region, the estimated consumption by livestock being 90 per cent of the crop, and by the human population 10 per cent.

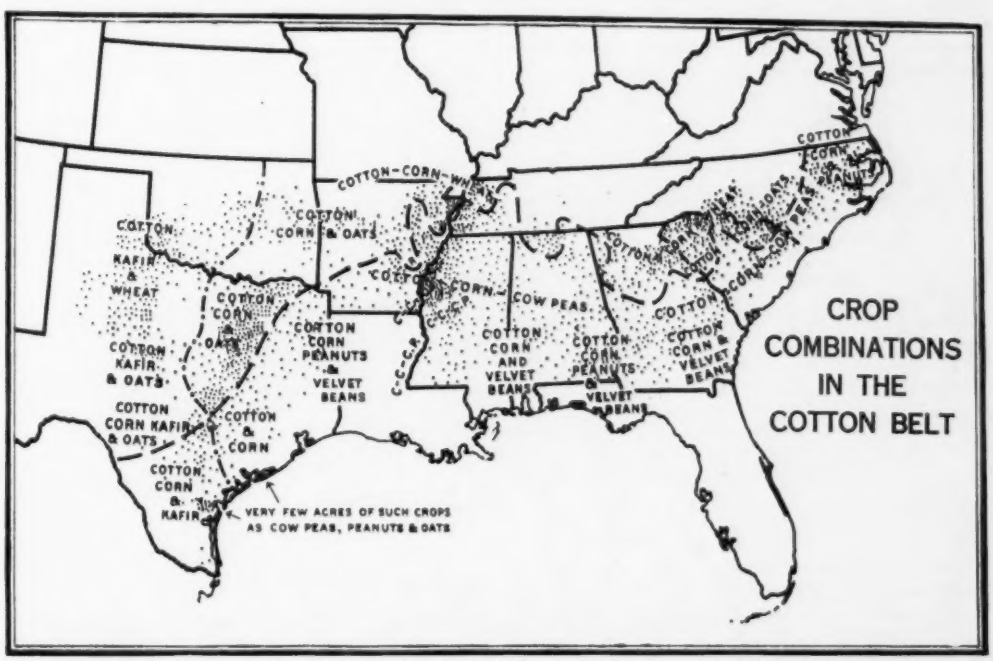

COTTON-CORN-WHEAT
COTTON CORN & OATS
COTTON KAFIR & WHEAT
COTTON CORN & OATS
COTTON KAFIR & OATS
COTTON CORN PEANUTS & VELVET BEANS
COTTON CORN KAFIR & OATS
COTTON & CORN
COTTON CORN & KAFIR
VERY FEW ACRES OF SUCH CROPS AS COW PEAS, PEANUTS & OATS
CORN-COW PEAS
COTTON CORN AND VELVET BEANS
COTTON CORN PEANUTS & VELVET BEANS
COTTON CORN & VELVET BEANS
CROP COMBINATIONS IN THE COTTON BELT

FIGURE 67.—North of a line drawn from Virginia down the Piedmont into Georgia, thence westerly into Arkansas and southwesterly across Texas, wheat, oats, and rye appear in the cropping system. South of this line small grains rarely appear, their place being taken by large-seeded legumes. Another line drawn from the Kansas border across Oklahoma and Texas separates the region producing corn as the secondary crop from that in which the grain sorghums are more important. The dots show the distribution of cotton production in 1921. (Map prepared by R. R. Spafford, and published in 1921 Yearbook, U. S. Dept. of Agriculture.)

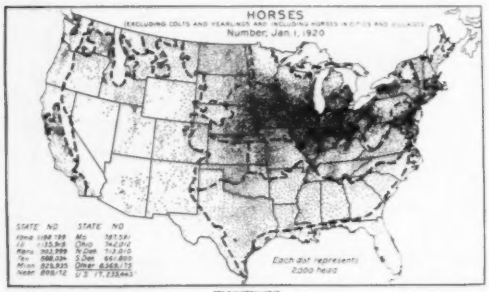
[7] Forty-two per cent of the crop land in the Cotton Belt was in Cotton, but after the value of the seed, most of which is used for feed and food, is allowed for, the acreage allotted to the production of cotton fibre becomes only 36 per cent.

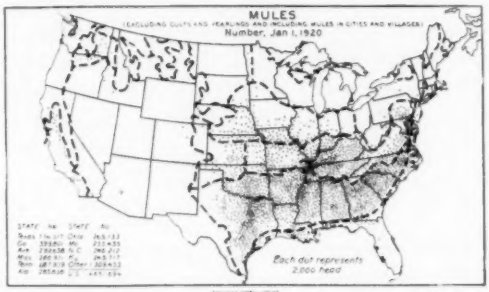
SYSTEMS OF FARMING

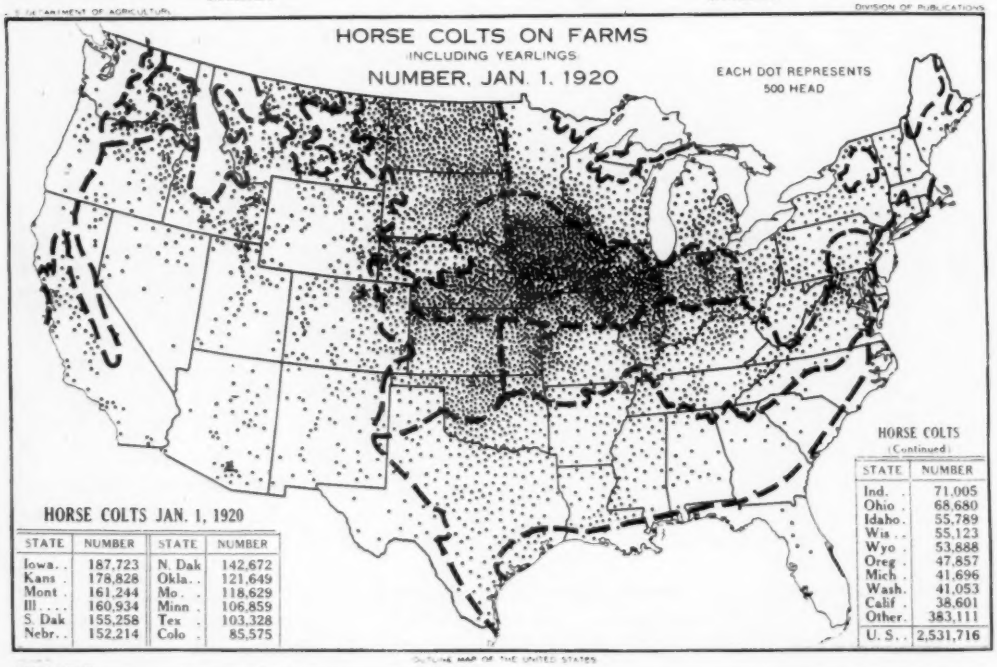
The characteristic and dominant system of farming in the Cotton Belt is simple.

COTTON AND CORN

The principal system of farming is based upon two crops, cotton and corn, which have been planted in succession or alternation until the productiveness of the soil, much of which is of low natural fertility in the eastern moister portions, has been so reduced that fertilizers are quite generally required for a profitable yield of the crops (Fig. 61). These crops are grown by nearly nine-tenths of all farm-





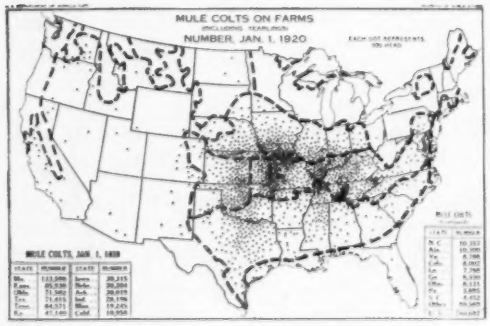


HORSE COLTS JAN. 1, 1920

STATE	NUMBER	STATE	NUMBER
Iowa..	187,723	N. Dak	142,672
Kans .	178,828	Okla..	121,649
Mont .	161,244	Mo. .	118,629
Ill....	160,934	Minn .	106,859
S. Dak	155,258	Tex .	103,328
Nebr..	152,214	Colo .	85,575

HORSE COLTS
(Continued)

STATE	NUMBER
Ind. .	71,005
Ohio .	68,680
Idaho.	55,789
Wis ..	55,123
Wyo .	53,888
Oreg .	47,857
Mich .	41,696
Wash.	41,053
Calif .	38,601
Other.	383,111
U. S..	2,531,716



FIGURES 68–71.—There are more mules (Fig. 69) and fewer horses (Fig. 68) per square mile in the Cotton Belt than in any other eastern agricultural region. But very few of these mules and horses are raised in the Cotton Belt, except in the western portion where there is more pasture, and, consequently, cheaper feed (Figs. 70 and 71). It is found that horses and mules can be grown more cheaply in the Corn and Winter Wheat Belt and in the Corn Belt to the north, and then shipped to the Cotton Belt when mature enough for work. (Adapted from maps in 1921 Yearbook, U. S. Dept. of Agriculture.)

ers in the region. As much cotton is grown as the farmer (commonly a tenant) and his family can pick, usually about 20 acres; then as much corn is grown as the time remaining from the cotton cultivation and picking permits, normally 10 to 15 acres. The more progressive farmers also grow a few acres of forage crops, principally oats (cut green for feed) in the northern portion of the belt, cowpeas, peanuts, soy beans, and velvet beans, varying with the locality, in the southern portion (Fig. 67). So far as possible these supplementary crops are cultivated when work on the cotton or corn is not pressing (Fig. 66). Cotton is the "cash crop" and the corn provides the "hog, hominy, and hoecake" which are the characteristic foods of the region. Forty-two per cent of the crop land in the region was in cotton and 31 per cent in corn in 1919, and about 5 per cent each in wheat, oats, and hay, including the animal legumes cut for hay (Fig. 73). The wheat is grown almost wholly in the drier western Oklahoma and Texas portion of the Cotton Belt (Fig. 14), and here the grain sorghums, kafir especially, become more important than corn in many counties. The remaining 12 per cent of the crop acreage was made up of many minor crops, of which tobacco, vegetables, sweet potatoes (Fig. 74), and fruit were the most important. The tobacco and fruit are each grown mostly on specialized farms, for the northern market.

But in recent years a dark cloud has crept eastward across the Cotton Belt—the boll weevil. This scourge now covers practically all the Cotton Belt, except the sub-humid section in western Texas. The only satisfactory means of control yet discovered, that of poisoning, can be done profitably only on fertile soils; that is, where the yield of cotton ordinarily exceeds one-third of a bale to the acre, or under favorable circumstances one-quarter of a bale. The problem of a profitable system of farming is, therefore, very acute in the South. Various crops and systems of farming are being urged upon the farmers, but none appear to offer to any large number of farmers the assurance of a profit equal to that afforded by cotton prior to the advent of the boll weevil.

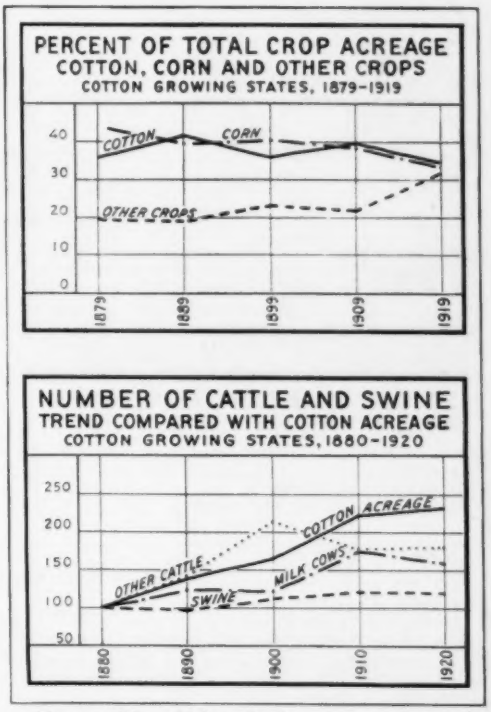


FIGURE 72.—Although the cotton acreage declined in relative importance between 1909 and 1919 in the cotton growing states and other crops increased, it is significant that cotton acreage increased more rapidly between 1910 and 1920 than the number of beef cattle, milk cows, or swine, and that this is true also for the 40-year period, 1880–1920, as a whole. In other words, the acreage of cotton has been increasing more rapidly than the number of livestock in the South. (Graph prepared by O. C. Stine, and published in 1921 Yearbook, U. S. Dept. of Agriculture.)

"DIVERSIFIED" FARMING

The most promising system of farming possessing any possibility of wide application is that of producing corn and hay or forage to feed livestock, principally cattle and hogs. Although the acreage of corn in the Cotton Belt is, in many counties, about equal to that of cotton, not enough corn is grown in the Cotton Belt as a whole to meet the region's needs. Large quantities of hay also are imported from the states in the North. The price of corn in the Cotton Belt

DAIRY CATTLE PASTURING COWPEAS

FIGURE 73.—The picture shows a field of cowpeas planted for green manure purposes in a pecan orchard in Florida. After being pastured off, the residue is plowed under to enrich the soil. Velvet beans, soy beans, and peanuts are likewise pastured off in this manner, mostly by cattle or hogs. (Photograph by W. H. Bailey, 1923 Yearbook, U S. Dept. of Agriculture.)

averages about twice that in the Corn Belt, and the price of hay is about 50 per cent higher. It would seem, therefore, that the production of corn and hay would be a profitable enterprise in the Cotton Belt.

But the average yield per acre of both corn and hay is only about half that in the Corn Belt; consequently, the acre value of corn or hay is no greater in the Cotton Belt than in the Corn Belt. These high prices of corn and hay in the Cotton Belt are consumers' prices. If the Cotton Belt produced more corn and hay than it consumed, and needed to ship the surplus to the North, whether as corn and hay or transformed into hogs and cattle, it could secure only a producer's price for its products, which would be probably about half the present prices. The production of corn, hay, cattle, and hogs in the Cotton Belt, therefore, appears likely to be profitable only up to that point at which the supply of these products does not exceed the local demand.

Hay in the Cotton Belt suffers from a climatic, as well as a soil-fertility, handicap. The old South is the rainiest part of the United States in summer and the rains are so frequent that it is difficult to cure hay. In the western portion of the Cotton Belt, especially in central Texas and Oklahoma, the summer weather is drier and hay is a more important crop (Fig. 16). Oklahoma, in fact, produces a slight surplus for shipment out of the state. But from Louisiana and Arkansas eastward a large proportion of the hay is lost in curing, and much of the remainder is more or less damaged by untimely rains.

The handicaps in producing livestock are caused mostly by temperature conditions. Both cattle and hogs in the South are afflicted with many parasites. The cattle tick, which disseminates Texas fever, is gradually being eradicated, but many other diseases remain to be controlled. The hogs, likewise,

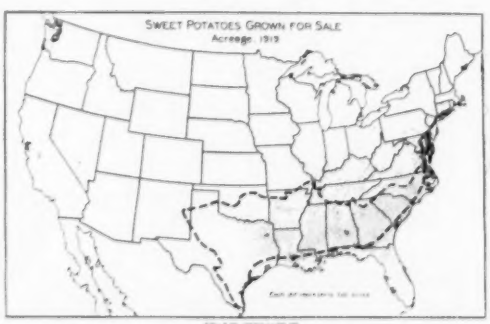


FIGURE 74.—Sweet potatoes rank next to corn in importance among the food crops of the South. Nearly every farmer, both negro and white, has a sweet potato patch. Even the acreage grown for sale, it will be noted, is rather smoothly distributed throughout the humid portion of the Cotton Belt. (Map supplied by Bureau of Agricultural Economics, U. S. Dept. of Agriculture.)

COTTON GIN IN SOUTHERN TEXAS

FIGURE 75.—This typical commercial plant shows the octagonal storage house for seed cotton, with the modern system of pneumatic unloading and conveying pipes. Each wagon holds enough seed cotton (about 1,500 pounds) to make a bale of lint (weighing 500 pounds). (Photograph from 1921 Yearbook, U. S. Dept. of Agriculture.)

suffer from several diseases not common in the North, caused mainly by worms. The infestation is more severe than in the North, probably because the ground never freezes to an appreciable depth, and the eggs or larvae of the worms are able to live in the ground from year to year. Cattle and hogs can be raised profitably in the Cotton Belt, especially for the local market, but to raise high-class stock and keep the animals free from disease requires greater vigilance than in the North.

THE PROSPECT

It seems almost certain that the Cotton Belt will continue to grow as large, indeed probably an increasing acreage of cotton, but with a smaller yield per acre than in past years, because of the boll weevil. Since the rest of the world cannot at present produce enough cotton to meet the need, the product will sell at a higher price than before the arrival of the weevil. There will be some increase in the production of corn and of forage crops in particular, and gradually more and better cattle and hogs will be raised; nevertheless, cotton probably will remain the dominant farm enterprise, and the region will continue to deserve the name by which it is commonly known—Cotton Belt.

TENURE AND SIZE OF FARMS

Many of the farms of the Cotton Belt, more particularly in the portion from Louisiana to Arkansas and eastward, are organized somewhat differently from those in other parts of the United

CULTIVATING COTTON IN TEXAS

FIGURE 76.—In Texas and Oklahoma a two-mule (or horse) cultivator is commonly used, which cultivates both sides of the row of cotton, while in the "Old South" to the east, a "one-mule plow" is more common. Recently in western Texas two-row cultivators have come into use, pushed by a tractor and operated by only one man, and in 1926 a few four-row cultivators were being tried out. The labor of picking is likewise lightened by using tools that comb the entire ball from the plant, dependence being placed upon the modern gin for removing the burrs, leaves, and dirt from the cotton. (Photograph from 1921 Yearbook, U. S. Dept. of Agriculture.)

States, owing largely to the presence of the negro race, most of whose ancestors were slaves. The census figures of size of farms fail to take this feature into account.

The plantation before the Civil War was a large farm operated under one management with slave labor, frequently directed by an overseer. After the slaves were freed, the "cropper" system was established, and the "plantation" some sections are called "half-hands," or "half-renters," because they get half the crop. The cropper is usually closely supervised by the owner of the land or by an overseer employed by him.

The plantation system is largely confined to the more fertile portions of the "Old South." Texas was a part of the United States for only a few years before the Civil War, so that slavery and

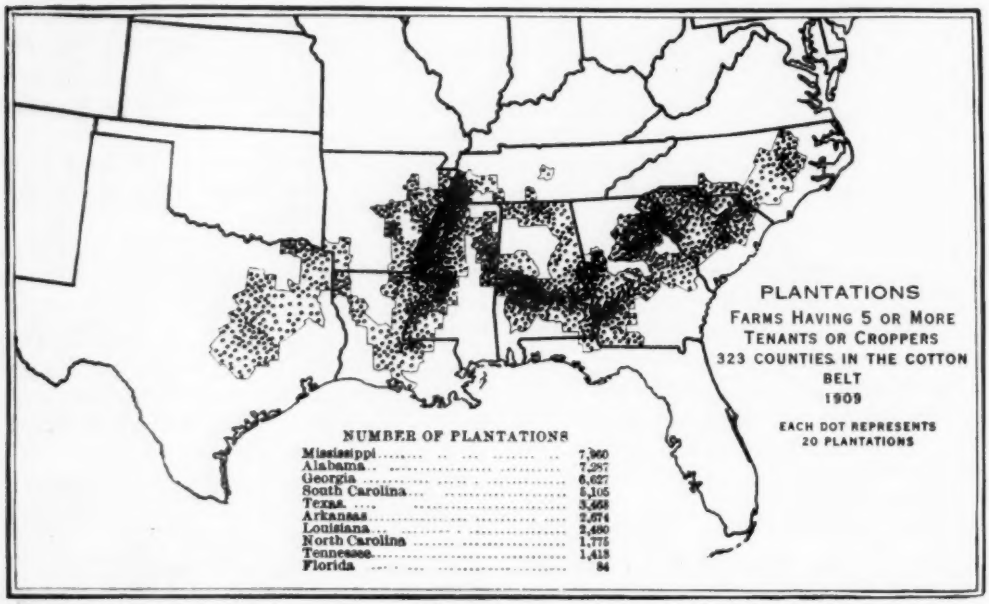


FIGURE 77.—The plantations represented here are those tabulated in 1910 by the Bureau of Census for 323 counties in the Cotton Belt. The tabulation was confined to those counties in which the plantation system of management is extensively employed. Plantations are more numerous in the eastern portion of the Cotton Belt, where the slavery system was well developed before the Civil War, and are most numerous where the soils are best adapted to cotton production. (Map from Cotton Section, Atlas of American Agriculture, U. S. Dept. of Agriculture.)

may now be defined as a large tract of farm land operated under one management by wage hands and croppers (Fig. 77).

Wage hands are usually paid a stipulated cash wage per month, and furnished a house, wood, and rations. The wage hands are employed principally in growing the feed crops and keeping up the plantation, while most of the cotton is grown by the croppers. In the census reports, each cropper is classed as a tenant, but legally he is a laborer paid by a share of the crop instead of cash. In the South, croppers are regarded as a higher class than wage hands, and in the plantation system did not have time to develop there to an appreciable extent. Oklahoma has no plantations, as it has been settled in recent years.

About 31 per cent of the farms in the Cotton Belt are "operated" by negro "tenants," according to the census, who are mostly croppers on plantations (Fig. 33); and 7 per cent are operated by negro owners (Fig. 32). White tenants operate 30 per cent of the farms (Fig. 31), and white owners 32 per cent (Fig. 30). Thus, three-fifths of the farms of the Cotton Belt are operated by white men, and more than three-fifths of the

cotton is produced by them. This large proportion of white cultivators is owing largely to the fact that there are relatively few negro cultivators in Oklahoma and Texas.

Plantations in 1909, the last year for which figures are available, ranged in size from an average of 654 acres in North Carolina to 904 acres in Louisiana. Almost 40 per cent of the land was handled by wage hands, and 60 per cent, including most of the improved land, was rented to croppers. The typical negro cropper farm is about 40 acres in size, of which about 30 acres are in crops, consisting of 18 to 20 acres of cotton, 8 to 10 acres of corn, occasionally a few acres of winter oats or cowpeas, and a sweet potato patch. The livestock on about two-thirds of these negro cropper farms consists of a mule, or occasional horse, a cow, two or three pigs, and ten to twenty chickens. Cotton is the cash crop with which the cropper pays his rent, buys his clothing and the groceries he uses, in addition to the supplies produced at home.

The white-tenant farms average 60 acres in size, about 35 acres being in crops, and 20 acres in cotton. The white owner-operator farms, excluding portions of plantations rented to croppers and tenants, average about 150 acres in size, with 40 acres in crops, of which 20 acres are cotton.

In the Texas and Oklahoma portion of the Cotton Belt, white tenants are more numerous than colored, and owners are almost as numerous as tenants. The white-tenant farms are double and treble the size of the negro-cropper farms in the eastern Cotton Belt, having three or four horses or mules to the farm. The farms operated by owners are still larger (Figs. 25 to 28).

The tendency in nearly all parts of the Cotton Belt is still toward smaller farms, but in the southwestern portion, possibly owing to the longer duration of the boll weevil infestation, there is a slight trend toward a larger acreage of improved land per farm. The size of a cropper or tenant farm in the Cotton Belt is determined largely by the amount of cotton this farmer can produce, and this is limited by the amount he and his family can pick between September and December. The invention of a successful cotton picker would revolutionize agricultural conditions in the Cotton Belt.

THE PEOPLE

The white farmers of the South are almost wholly of native American stock, foreign immigrants having avoided the low wages and the social status which characterize farm laborers and tenants in this region. About 64 per cent of the rural population of the Cotton Belt is white, and 36 per cent negro. In Mississippi and South Carolina the negroes exceed the whites in number. The negroes exceed the whites in number also in most of the plantation areas.

The farm population of the Cotton Belt increased about 11 per cent between 1900 and 1910, and 4 per cent between 1910 and 1920, but decreased about 440,000 or 4 per cent between 1920 and 1925, owing to the agricultural depression and the resultant migration of many negroes, especially, to the North. This decrease was confined to the Eastern and Central (forested) sections of the Cotton Belt. In this portion the decrease in farm population averaged 8 per cent, whereas in the western Prairie and Plains portion farm population increased 5 per cent. Similarly crop land between 1919 and 1924 decreased 9 per cent in the Cotton Belt east of Texas and Oklahoma and increased 16 per cent in Texas and Oklahoma. It is significant that, although the increase of farm population between 1910 and 1920 was only 4 per cent, improved land increased 7 per cent and crop land 19 per cent. Likewise, in Texas and Oklahoma farm population increased only 5 per cent between 1920 and 1925 while crop acreage increased 16 per cent between 1919 and 1924. In the South, as elsewhere in the United States, the trend until 1920 was toward a larger acreage of crops per farm,

larger production per man and, consequently, toward greater general prosperity. This trend has continued in Texas and Oklahoma. But in the Eastern and Central portions of the Cotton Belt, crop acreage between 1919 and 1924 decreased a little more rapidly than population. This depression is undoubtedly transient, as the 1925 season shows a great improvement of the agricultural situation in the region.

The Cotton Belt is predominantly rural, over two-thirds of the population living outside unincorporated places (Fig. 34). This is a larger proportion than in any other agricultural region. About 10 per cent lived in villages of under 2,500 people, and 22 per cent in cities of 2,500 people and over, on January 1, 1920 (Fig. 35).

Both the white and negro people of the Cotton Belt are prevailingly religious in sentiment, and strongly Protestant. Despite the very high proportion of the population which is of American stock, and the strong religious sentiment of the people, the percentage who are illiterate, among the whites (15 per cent) as well as among the negroes (27 per cent), is higher than in any other agricultural region.

The natural increase of the population (excess of births over deaths) is greater in the Cotton Belt than in other portions of the United States, and is higher among the white population than among the negro. The high birth rate is undoubtedly owing principally to the rural environment of most of the people and to their religious faith.

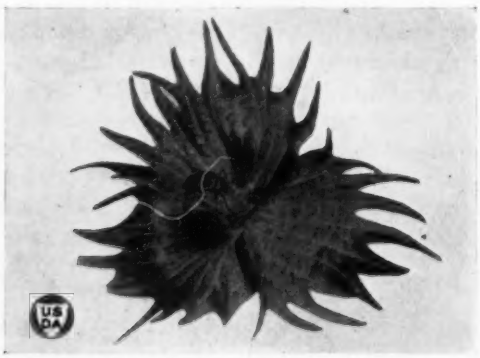


FIGURE 78.—Cotton boll weevil puncturing young flower bud (natural size).

A GEOGRAPHIC RECONNAISSANCE OF TRINIDAD

Preston E. James

Assistant Professor of Geography, University of Michigan

TRINIDAD'S geographic landscape is one of great variety. Within the island's 1,862 square miles of area, the natural forms of the landscape include rugged mountains and swampy plains, areas of heavy rainfall and areas deficient in rainfall. The cultural forms include a modern city with its teeming life, backward, rural communities and isolated farms, areas where agriculture is the dominant economy, and areas where the destructive economy of an oilfield prevails.

Located only 10° north of the equator, off the mouth of the Orinoco River, the climate of Trinidad may be classified as "rainy low latitude," having the usual uniformly high temperatures and the seasonal rhythm of rainfall.[1] On the eastern side of the island, and especially on the precipitous slopes of the Northern Range (Fig. 1) there is a rainfall of over 150 inches; but on the shores of the Paria Gulf less than 60 inches fall in an average year (Fig. 2). This distribution of rain-

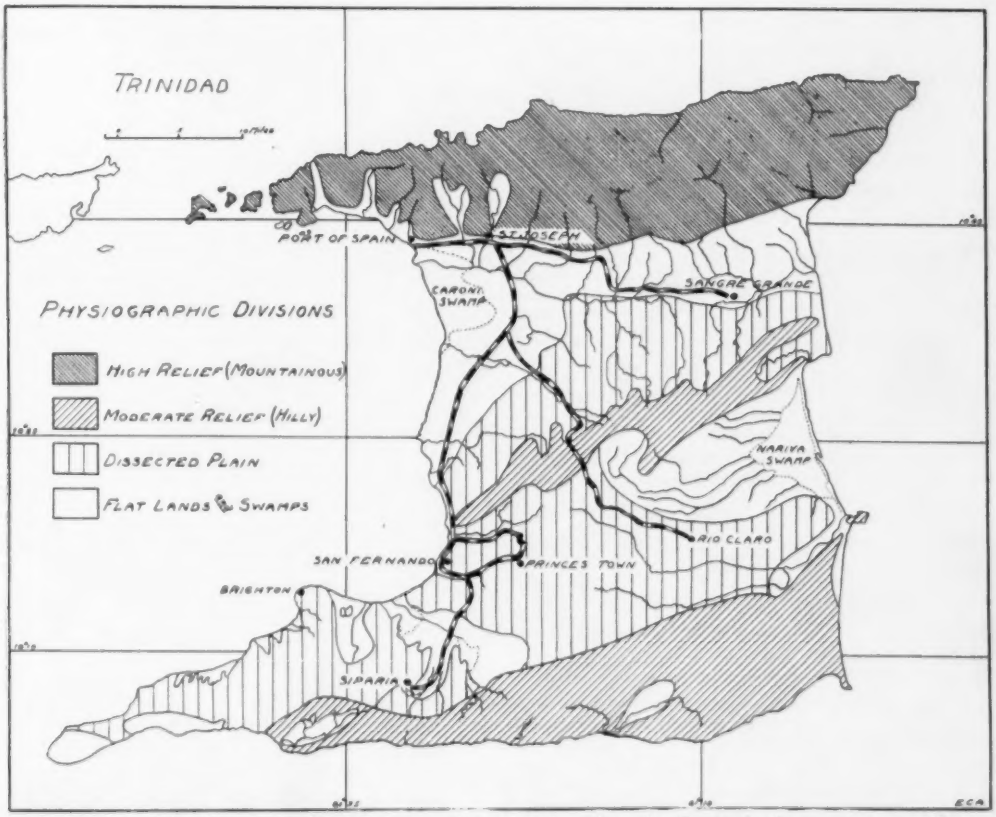


FIGURE 1.—The Physiographic Divisions of Trinidad. Though climate is the most general factor affecting life and industry in Trinidad, the relief and drainage help to determine the distinctive divisions of the island.

[1] P. E. James, "The Climate of Trinidad, B. W. I.," *Monthly Weather Review*, Vol. 53, Feb. 1925, pp. 71–75.

fall is reflected in the distribution of the chief cultural forms of the island, those associated with the cultivation of cacao occupying the rainy eastern districts, while those associated with sugar cane are found on the sunnier western side. Furthermore, little of the surface of Trinidad is flat. A mountain chain crosses the northern part from west to east (Fig. 1), and south of it, two parallel hilly belts trend roughly in the same direction. Thus, while the rainfall divisions run north and south, the land surface divisions run east and west, creating a checkerboard of natural conditions and inducing a great variety of human adjustments.

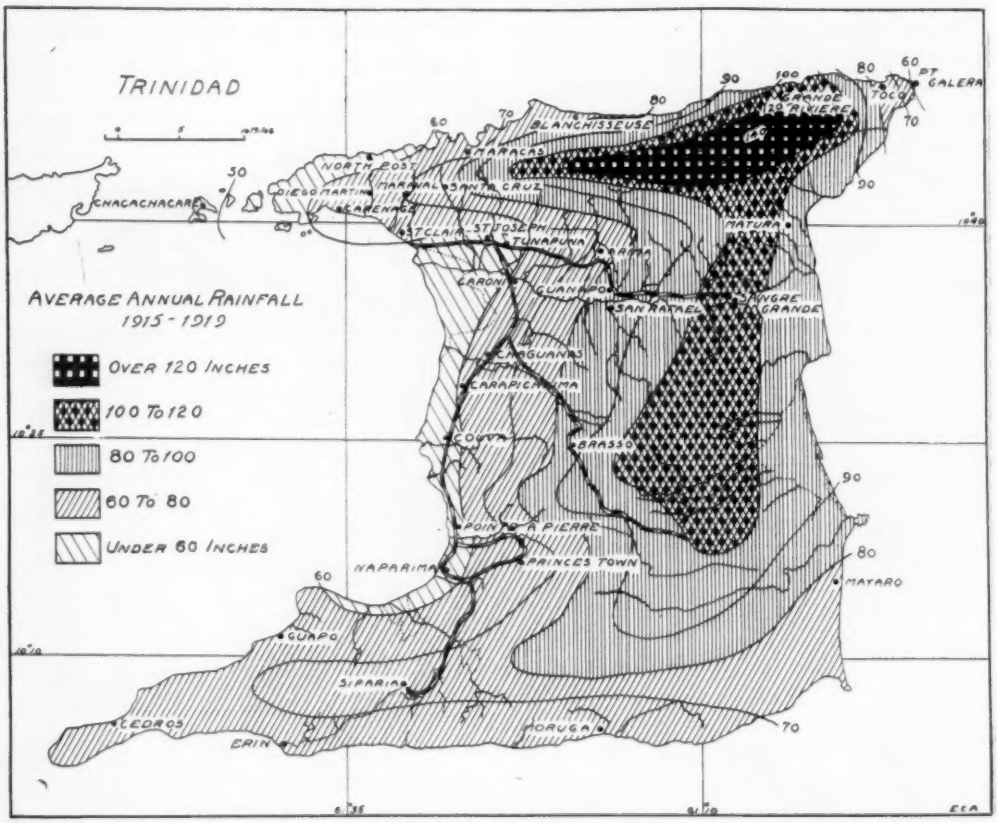


FIGURE 2.—The average annual rainfall of Trinidad from 1915 to 1919 inclusive affords a fairly reliable basis for such a map as this. The relation of location and relief to rainfall distribution is evident.

The inhabitants of Trinidad are primarily interested in agriculture. Outsiders are, perhaps, more familiar with the asphalt lake and the oilfields, and these resources support small communities entirely unlike the settlements in other parts of the region. Oil and asphalt, however, are only indirectly important to the greater number of Trinidadians. The dominant interest is in the major crops, cacao and sugar cane, and in such other crops as coconuts, rice, and timber. About 40 per cent of the island is cleared for agriculture, the remaining 60 per cent being forest or waste land.

DISTRIBUTION OF POPULATION

The total population of Trinidad in 1921 was 342,523.[2] The most densely populated areas are found in the drier and sunnier parts of the island, and in

[2] Statistics of population, nationalities, and occupations from the Census of the Colony of Trinidad and Tobago, 1921, Port of Spain, Trinidad, 1923.

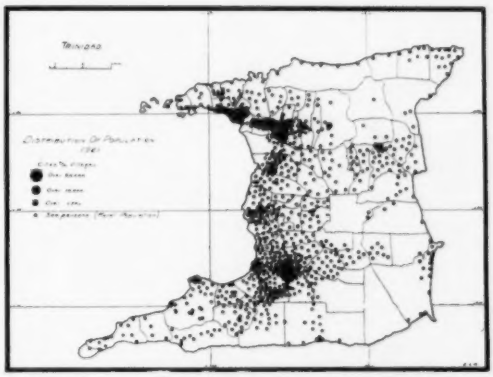


FIGURE 3.—The distribution of population in 1921. It is a function of physical factors and the distribution of industries affected by them. Climate, relief, and soil are important factors.

the areas of relatively low relief between the mountainous and hilly belts (Fig. 3). The northern area, centering on Port of Spain, occupies the flat land (Fig. 1) along the base of the Northern Range. The southern area is located on the undulating lands of the dissected plain between the Central and Southern Hilly Belts. San Fernando is the chief city of this section. In these crowded parts of the island there are about 1,000 people per square mile. On the other hand, the rainy and mountainous portions are sparsely inhabited (Table 1).

TABLE 1

	People Per Square Mile
Western Counties	
St. George	215
Caroni	213
Victoria	214
Eastern Counties	
St. David	85
St. Andrew	82
Nariva	42
Mayaro	25
Southwestern County	
St. Patrick	130

CITIES AND VILLAGES

The largest city on the island is the capital, Port of Spain, located at the outlet for the largest productive area, and the area with the densest population (Fig. 3). This city ships most of the products of the island. It had a population in 1921 of 61,580 people. Associated with it are the smaller towns and villages scattered along the base of the mountains, of which the more important ones are St. Joseph (Fig. 1), Tunapuna, Arouca, and Arima (Fig. 2). This part of the island was the first to be settled, the early capital being located at St. Joseph on the lower slopes of the Northern Range and back from the coast, partly to avoid the fevers which were common close to the Caroni Swamp (Fig. 1), and partly to avoid the pirate raids to which coastal cities were exposed.[3] An important consideration, too, leading to the location of the earliest settlement on this side of the island was no doubt the protected anchorage which could be found in the calm waters of the Paria Gulf, for the other coasts of Trinidad are dangerous, owing to swirling currents or heavy breakers.

The second city of Trinidad is San Fernando, with a population of 10,610. This city and Princes Town (Fig. 2) are the supply centers for the southern area of dense population. San Fernando does not ship the products of this part of Trinidad, almost everything produced on the island excepting oil and asphalt being exported through Port of Spain. A number of other towns are found close to the Gulf Coast within the area of notably denser population which borders that side of Trinidad. These towns, from north to south, are Chaguanas, Couva, and California. Only one town, Sangre Grande, with a population over 1,500 is found in the rainy eastern part of the island.

RACIAL AND NATIONAL ELEMENTS OF THE POPULATION

The population of Trinidad is remarkably heterogeneous. There are three major racial elements: whites, negroes, and East Indians. Because of the free intermixture of whites and blacks which has prevailed in Trinidad from Spanish times, it is practically impossible to make a division between these two in the

[3] L. A. A. DeVerteuil, "Trinidad: Its Geography, Natural Resources, Administration, Present Condition, and Prospects," London, 1884, p. 431.

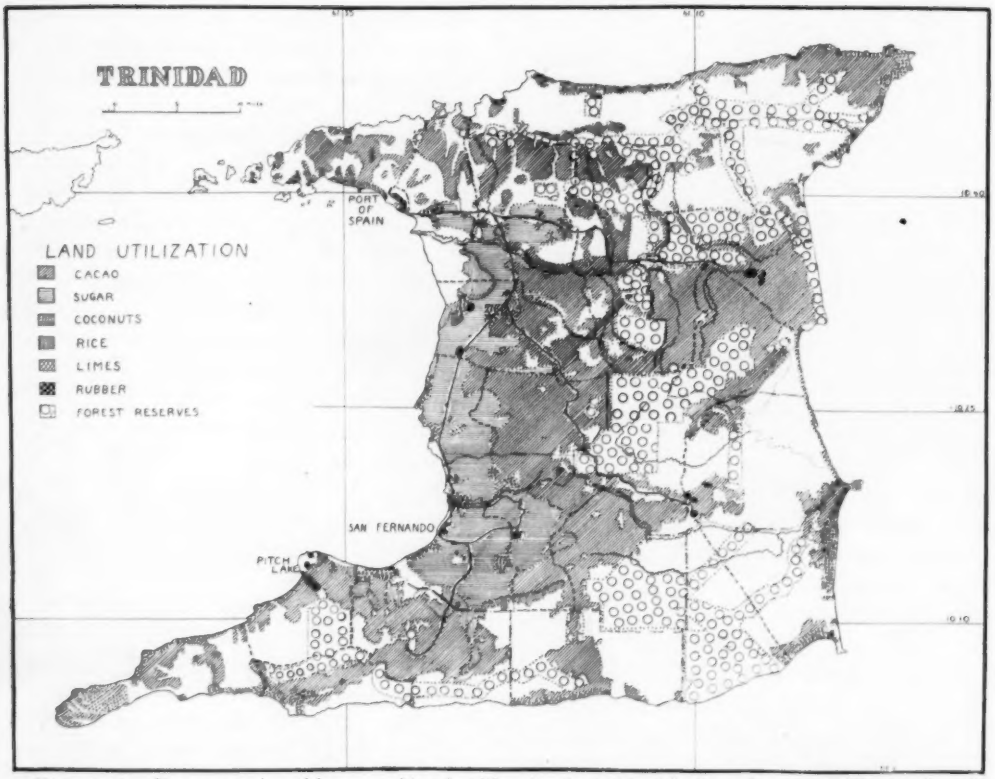


FIGURE 4.—By comparing this map of land utilization in 1923 with the other maps illustrating the article, the close relationship between the use of the land, the physical factors, and the population is clearly expressed.

census. Native born Trinidadians are recorded as such, regardless of the shade of color. However, speaking in very general terms, about one-third of the total population is white or almost white, and about one-third is obviously black. There are relatively few whites, however, who can trace an unmixed white ancestry. The East Indians were brought into Trinidad as indentured laborers between 1845 and 1916 to relieve the labor shortage in the sugar fields. Many elected to remain in Trinidad after their contracts were up, and in 1921 the East Indians made up another third of the population, namely 121,420 persons. In addition to these, one finds here and there, especially in the more remote parts of the island, a few of the original native Indian types. All possible combinations of ancestry between these racial groups greatly complicate any racial study.

Although Trinidad is a British Colony, its inhabitants are made up of many different nationalities. Up to 1797 (1802) Trinidad belonged to Spain, and many of the customs established in those days have prevailed to the present. The lack of a color line, for example, is typically Latin. In 1783 many Frenchmen came to Trinidad which was then much

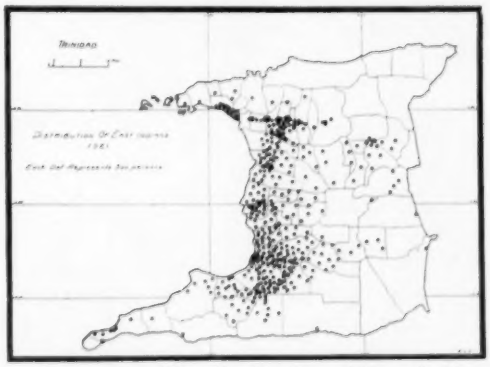


FIGURE 5.—The distribution of East Indians (1921) is consequent upon their labor in the sugar districts.

under-populated.[4] People from the more crowded West Indian islands moved to Trinidad at this time bringing the more alert types and stamping the Trinidadians with the character of progressiveness and activity which sets them off today from the inhabitants of many of the other West Indies. After the island became a British Colony, many people from England came out to Trinidad to remain there permanently. There are also a number of Venezuelans, as well as a few people from other parts of South America, and over a thousand Chinese.

RELATION OF POPULATION DISTRIBUTION TO THE USE OF THE LAND

The density of population is closely related to the use which is made of the land (Fig. 4). The areas of denser population along the Gulf Coast and around San Fernando are used for the production of sugar cane, which supports great numbers of agricultural laborers. The distribution of East Indians (Fig. 5) is also closely correlated with the sugar district in which most of them work. All but two of the cities of over 1,500 (Fig. 3) are located either in or on the margin of the sugar district. The other two cities, Arima and Sangre Grande, are in the area devoted to cacao plantations. This crop requires relatively less labor and is marked, consequently, by a sparser population. Several local concentrations may be seen near Brighton (Fig. 1) where people are gathered to work the Pitch Lake or the several oil fields nearby.

THE GEOGRAPHIC DIVISIONS OF TRINIDAD

In order to present more clearly the geographic picture of Trinidad it is necessary to define, describe, and interpret the landscape types which are found there. The term "landscape" in this sense connotes the natural and cultural forms which, in varying combinations, give varying expression to the earth's surface. Cultural forms, resulting from the activities of man, are as much a part of a landscape as the site, or natural setting, in which these cultural forms are cradled.[5] The whole surface of the earth is the only unit of landscape: composed of an infinite variety of expressions all shading into neighboring expressions, it is quite natural, but puzzling to the human mind which looks for exactly defined parts. For our purposes, then, the areas occupied by the several landscape types in Trinidad are mapped as closely as possible (Fig. 6). Geographic divisions called districts and communities are recognized, but the reconnaissance nature of the work did not permit the further division into localities and plats.

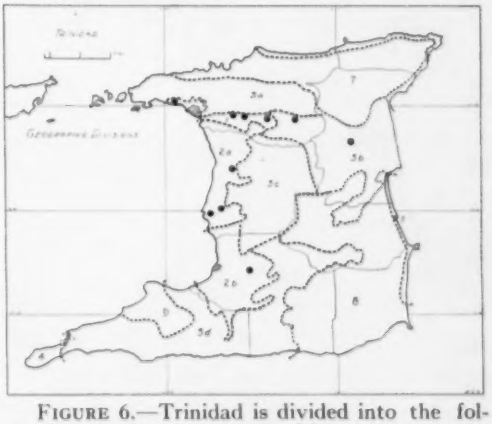


FIGURE 6.—Trinidad is divided into the following districts and communities:

1. Port of Spain Market Crop and Residence District.
2. The Sugar District:
   a. Caroni Community.
   b. San Fernando Community.
3. The Cacao District:
   a. Northern Mountain Valley Community.
   b. Sangre Grande Community.
   c. Montserrat Community.
   d. Southern Community.
4. Cedros Coconut District.
5. Nariva-Mayaro Coconut District.
6. North Coast Coconut District.
7. Northern Range Peasant Proprietor District.
8. Southeastern Undeveloped District.
9. Pitch Lake and Oilfields District.

[4] B. Edwards, "The History Civil and Commercial of the British West Indies," London, 1819, p. 297 ff.
C. Kingsley, "At Last: A Christmas in the West Indies," London, 1885, Chapter III.

[5] C. O. Sauer, "The Morphology of Landscape", University of California. Publications in Geography, Vol. 2, pp. 19–53, 1925.

PORT OF SPAIN MARKET CROP AND RESIDENCE DISTRICT

This district includes the densely populated area along the southern piedmont of the Northern Range from a point a little west of Port of Spain eastward to Arouca. A paved highway runs the length of the district, and along it are strung a series of contiguous towns, forming an almost continuous agglomeration of people. Separate houses, small, built of wood or mud, thatched or roofed with corrugated iron, alternate along this road with city blocks composed of openfront shops displaying all kinds of wares, or of wooden, two-story tenements. The highway is crowded with people on foot, or riding uncomfortably on two-wheeled burro carts, or packed into the autobusses which run in and out of Port of Spain. In the background to the north the forest-covered slopes of the Northern Range rise abruptly from the plain, and the piedmont towns climb but a short distance up their sides. During the day shower after shower sweeps westward along these mountains, the swish of the rain falling on the trees of the forest being distinctly audible in the sun-baked lowlands where showers occur less frequently (Fig. 2). To the south are the level stretches of the Caroni Plain, marked off into fields of sugar cane, and near the coast, the dark green labyrinth of the Caroni Swamp.

TRADING AND RESIDENCE

The towns of this district function as trading centers for the districts to the north and south, and as residence sections for the city workers in Port of Spain. Early in the settlement of Trinidad, the piedmont became a meeting place for the people from the cacao estates in the mountain valleys to the north, and from the sugar estates on the plain to the south. The towns grew up in most cases where the mountain valleys debouch on the plain, and in the course of time have expanded east and west until now their limits are scarcely distinguishable. The products of the neighboring districts were concentrated along the piedmont, and carried to Port of Spain over the road, and in 1876 the railroad which was built to Arima.[6]

Many of the workers in Port of Spain buy small patches of land and homes outside of the city, so that the towns of this district do not have a purely commercial form. There are many private homes, some of them expensive, but most of them maintained by middle-class people who find the city too crowded and prefer to live outside. Each morning commuters fill the trains and autobusses on their way to work; and every evening the current moves back again away from the city.

MARKET CROPS

The increase of population in Port of Spain has created a constantly growing demand for market crops of fruit and vegetables. The limited spaces between the town centers are filled by small land owners, growing such crops as corn, potatoes, or fruit on their diminutive holdings. Although this type of economy characterizes this district more than any other, there is a remarkably small amount of land devoted to such crops, and remarkably few of the people engaged in supplying Port of Spain with truck products. By far the greater number of persons work as agricultural laborers in the sugar fields to the south, or as city workers of various kinds in Port of Spain, or as merchants and clerks in the local stores. In fact many of the "peasant proprietors" use a large part of their small holdings for sugar cane which they sell to the large mills in the sugar district. Three things have contributed to this imperfect development of truck farming in the neighborhood of so large a market. First, higher prices are paid for work in the big sugar estates than the peasant proprietors could gain by independent production. The sugar estates in Trinidad have complained of almost chronic labor shortage

[6] "Railway Extensions in Trinidad," *Railway Age Gazette*, New York, 1910, pp. 867–869.

ever since the slaves were emancipated in 1834; and the importation of East Indians has only partially relieved this condition. Hence, there is always work when it is wanted in the estates nearby. Second, the prevalence of petty thieving makes the business of growing truck crops a hazardous speculation in a country where fences other than hedges are little used. Third, the competition in Port of Spain markets with fresh vegetables and fruits raised in Venezuela and the nearby British West Indies, such as Tobago and Grenada, where labor is relatively very cheap, cuts so severely into the profits on market crops that only a bare living can be secured from Trinidad grown products. The greater part of the food consumed in Port of Spain comes from outside of the island.[7] The products are brought to Trinidad in the small sailing vessels so common in West Indian waters, and by the steamers which run among the more important islands and from the mainland of Venezuela and the Guianas. Thus less land and fewer people are devoted to truck gardening than might be expected; nor does the future promise much change in this respect.

PORT OF SPAIN

The chief city of Trinidad is nestled on the narrow fringe of flat land along the Paria Gulf (Fig. 1), backed by the steep, forest-clad mountains. The steepness of these slopes seems to have discouraged the development of a high residential section, overlooking the commercial city. Furthermore, in the east, the Laventille Hills almost reach the coast, there being only room for the road and railroad to skirt the southern end between the hills and the Caroni Swamp (Fig. 1). The older and poorer part of the city is located at the base of these hills in the east and northeast, while the newer residential parts are being added in the northwest. The most exclusive residences are located around the Savannah, a large open park in the north-central section. The commercial city is located along the gulf shore in the southwest, and here a little new land has been reclaimed by filling, making possible a small seaward expansion.

Port of Spain is a thoroughly modern city. Its houses are for the most part neat and well kept, its streets are paved and clean. In the better residential sections shade trees provide a relief from the glare of the sun, and beautiful parks are filled with the variety of trees and plants which only can be found in tropical gardens. Sanitation is given special attention. Mosquitos are so rare that screens are not necessary on the houses, and dangerous epidemics occur perhaps less frequently than in many northern cities.

THE SUGAR DISTRICT

The sugar district is located along the Gulf Coast, extending from the Caroni Plain in the north to the Oropuche Swamp, a little south of San Fernando. Its area is roughly sixty-five square miles. The eastern margin of the district follows the trend of the isohyets (Fig. 2), lying a little east of the 75-inch rainfall line. Thus the district occupies the sunnier and less rainy parts of Trinidad. The justification of the sugar district as a separate unit lies in the similarity of the cultural forms of its landscape. Throughout most of the area the forest has been cut away, and

[7] In 1923, of the imports of fresh vegetables, 68% came from Venezuela and 25% came from the British West Indies other than Trinidad and Tobago. There is a large trade between Tobago and Trinidad in addition. Of the meat imported into the colony, dressed meats came largely from the Middle Latitude countries, over 65% of the beef and pork products coming from the United States; but the live animals for slaughter which made up 60% by value of the total meat imports came almost entirely from Venezuela and the neighboring British West Indies. Animals were divided as follows: Cattle, 95% from Venezuela, 5% from the B. W. I.; goats, 93% from the B. W. I., 7% from Venezuela; sheep, 98% from the B. W. I., 2% from Venezuela; and swine, 68% from Venezuela and 32% from the B. W. I.

Figures from "Report of the Collector of Customs on the Customs Revenue, Trade, and Shipping of the Colony for the Year 1923," Council Paper No. 54 of 1924, Port of Spain, 1924.

miles and miles of unshaded fields of cane swelter in the intense sunshine, or are freshened by the showers which drift westward across the district. Here and there patches of densely shaded cacao, or coconut groves, or groups of stately royal palms around the villages stand out as conspicuous landmarks in this area, otherwise treeless. The dense population (Fig. 3) is concentrated in small villages—white wooden barracks set up by the sugar companies (Fig. 7), or individual mud and thatch houses. These small agglomerations are scattered in various parts of the district so that the laborers will not have too far to go to reach the cane fields where they work.

FIGURE 7.—Sugar workers' village near San Fernando. The rolling, unshaded fields of cane, and the scattered village groups, are characteristic of the landscape of the San Fernando Community.

The district is divided into two communities on the basis of a difference of land surface character. The northern, or Caroni Community, occupies a flat plain, the reclaimable part of the Caroni Swamp, and is characterized by poor drainage and a rich black soil. The southern, or San Fernando Community, occupies chiefly the Dissected Plain (Fig. 1), a surface in late youth with a relief of little over 100-feet where the streams have cut steep-sided valleys. Here drainage and soil are both highly favorable to the cultivation of sugar cane.

NATURAL CONDITIONS OF SUGAR-CANE PRODUCTION

Sugar cane requires a heavy rainfall, 50 inches or more, for the best cane growth. It also requires abundant sunshine to increase the sugar content of the cane. Sugar does best under natural conditions, therefore; in a rainy low latitude climate where the rain comes in the form of violent showers followed by periods of brilliant sunshine. However, where rainfall is adequate, as in Trinidad, sunshine becomes the critical climatic factor in sugar production. The best part of Trinidad for sugar, from a climatic point of view, is the less rainy and sunnier western part. Penetration eastward, other things being equal, increases cane growth, diminishes sugar content, and increases the likelihood of cane diseases.

Sugar cane also responds very easily to soil conditions. A rich loamy soil is ideal, but some varieties of cane can

yield well on highly eluviated clays.[8] The danger of drought is greater on sandy soils, and in some years this may be a very critical factor in yield, owing to the shallow root system of the cane.

In addition to these natural requirements, the production of sugar for the world markets requires cheap transportation to a shipping port, and a large supply of agricultural labor in the cane fields and sugar centrals (Fig. 8).

FIGURE 8.—The cane harvest occupies the dry season from January to June. Cane must be brought to the centrals within twenty-four hours of cutting or the juice will ferment.

THE SUGAR DISTRICT AS AN EXAMPLE OF ADJUSTMENT

Accessibility to Port of Spain was the most critical consideration in the location of the first sugar estates. Some of the earliest plantings were made along the base of the mountains near Port of Spain where labor was abundant and where the forests had been cleared off close to the big cities. However, some excellent sugar lands were soon found near San Fernando, and the industry first achieved an important position in the economic life of the colony in this community. Labor was attracted to San Fernando and Princes Town, and in 1882 a railroad connection with Port of Spain was provided.

In 1836 the largest area of sugar in Trinidad, about 3,000 acres, was reported in the San Fernando Community.[9] By this time, however, sugar cultivation had spread far and wide to all but the very rainy or very mountainous parts of the island. There were 457 acres in Cedros, for example; and eight acres are reported for distant Toco, on the rainy northeast coast. Under the stimulus of high prices, cheap land, and slave labor, sugar had apparently been planted in places which, considering the optimum conditions set forth above, were actually low-grade sugar lands. Extensive methods were used on virgin soils with good yields. Even today this former widespread distribution of sugar is recorded by the old rusty cast-iron kettles, formerly used for boiling the syrup, now used for the collection of water for washing clothes, and for innumerable odd purposes which are seen in almost every village where sugar was formerly produced.

The emancipation of the slaves and the increasing competition of sugar with that grown in other parts of the tropical and extra-tropical world hastened the inevitable movement toward a closer adjustment to natural conditions. Cedros, for example, grew sugar cane until about 1890; but the scarcity of labor there as compared with the points closer to the centers of population, the greater cost of transportation as compared with points closer to the new railroad, and possibly also the prevalence of malaria in Cedros close to the undrained swamps (Fig. 1) along the coast, all combined to stifle the industry. Coconuts, a product requiring less labor and ideally suited to the soil conditions in Cedros, replaced sugar. Today practically no sugar is grown outside of the sugar district.

The eastern boundary of the sugar district is a moving one. At times of depression in the cacao market there is a tendency for the cacao planters nearby to cut down their trees and plant sugar cane. This is especially noticeable in the areas of better soil, relatively smoother land surface, and proximity to lines of transportation. The sugar

[8] B. A. Jones, "Report on the Sugar Cane Experiments for the Season between 1923–1924," Ste. Madeleine Sugar Company, Ltd., Trinidad, 1924.

[9] "The Trinidad Almanac and Public Register for the Year of Our Lord 1837," Port of Spain, 1838, p. 80.

area may shift a little farther east in the areas between the mountainous and hilly belts; but the cacao plantations in the Central Range are not likely to be cut down in favor of cane.

Just as important as the withdrawal from the poorer sugar lands, is the tendency to a more intensive use of the better lands. The multitude of small sugar estates, each with its expensive mill equipment, are gradually combining into a few large companies. Cane is sent over company railroads to a central point where a large mill is supported and where the by-products may be utilized. The Usine Ste. Madeleine, now the largest estate on the island, occupies the greater part of the San Fernando Community. This estate alone in 1924 turned out 17,203 tons of sugar or 33 per cent of the total production of the island.[10] At the present time there are only twelve sugar estates in operation. These large companies are spending considerable money on experimental work and other scientific studies of the cane industry.[11] The different varieties of cane are being studied in their relations to the different soil conditions. Thus the sugar industry is rapidly approaching the stage of intensive cultivation, a stage when the use of the land is closely adjusted to even the minor variations of the natural conditions.

THE LABOR PROBLEM

Perhaps the most serious of all the problems in tropical development is labor. In the early days of Trinidad this was partially solved by slaves imported from Africa; but after 1834 when the slaves were freed, the shortage was acutely felt.[12] In 1845 the first ship load of indentured East Indians arrived from Calcutta. The East Indians were largely absorbed by the sugar industry (Fig. 5). Many of them, when their contracts were terminated, elected to remain in Trinidad, and took out small farms in various parts of the island. Some occupy the land around the Caroni and Oropuche Swamps (Fig. 1), and produce paddy rice (Fig. 4).[13] In spite of this

FIGURE 9.—Rice growing on the southern margin of the sugar district in the Oropuche Swamp. The East Indians cling to their traditional diet, as well as dress and religion.

[10] "Trinidad Cane Farming and Sugar Crop Return for 1924." Compiled by Edgar Tripp & Company. Published in the *Proceedings of the Agricultural Society of Trinidad and Tobago*, September 1924, p. 437.

[11] B. A. Jones, *op. cit.*

[12] The following deal with this critical period in the history of Trinidad:

J. Stephen, "The Crisis of the Sugar Colonies," London, 1802.

W. H. Burnley, "Abolition de l'esclavage dans les colonies anglaises: Observation actuelle de l'isle de la Trinitie," Paris, 1842.

[13] B. H. Jones and Rev. Dr. Morton, "Rice Cultivation in British Guiana and Trinidad," *West Indian Bulletin*, Vol. 6, 1905, p. 170.

rice acreage (Fig. 9), there is a large annual import of rice from British Guiana. In some cases these East Indians and also many negroes have been encouraged to plant sugar cane on rented land and sell the cane to the large mills. These cane farmers, as they are called, provided about 42 per cent of the cane crop in 1924.[14] They numbered 9,952 East Indians, and 7,116 so-called West Indians, chiefly negroes. The proportion of the crop produced by cane farmers has steadily increased from its beginning in 1884. In 1899 the farmers accounted for about 20 per cent of the total crop. There is a tendency, therefore, for the mills to be increasingly dependent on these small workers for their cane. Only a tremendous influx of cheap labor from outside, or an increase in mechanical tillage, can counteract this tendency.[15] The former event is unlikely. If mechanical tillage increases in importance, its chief use will be in the Caroni Community, for the rolling surface of the Dissected Plain around San Fernando will greatly hinder such forms of cultivation.[16]

THE CACAO DISTRICT

Cacao has been the chief crop of Trinidad since early colonial times. At present there are about 200,000 acres of this crop, covering approximately 17 per cent of the island. The cacao district includes the whole central part of Trinidad from the Northern Range to the southern shore (Fig. 6). As in the case of the sugar district, the cultural forms dominate the geographic complex, and the varying character of the land surface is expressed in four subdivisions. The whole district is densely forested, not by a primary forest, but by a secondary forest of low cacao trees, shaded by the taller "Bois Immortelle." The line between this and the sugar district is sharply defined by the change from open fields to densely shaded plantations, reeking with dampness, and filled with the odors of moist vegetation and the penetrating smell of cacao (Fig. 10). The roads, in many places bordered by hibiscus or coffee hedges, are dark and wet. The population is distinctly sparser than in the sugar district (Fig. 3), but is gathered in a similar way into village agglomerations around the estate buildings. These estate groups generally occupy small clearings in the cacao forest. The estate owner's home, a large wooden house with broad verandas and roofed with red-painted, corrugated iron, is surrounded by work houses, laborers' barracks, and cacao-drying sheds (Fig. 11). Here living conditions are distinctly primitive because of the

FIGURE 10.—The still air within a cacao forest is oppressively hot and moist—the conditions best suited for cacao, but trying for those who cultivate it.

[14] "Trinidad Cane Farming and Sugar Crop Return for 1924," *loc. cit.*

[15] W. G. Freeman, "The Trinidad Cane Farming Industry—Its Past and Suggestions for its Future," *Bull. of the Department of Agric. of Trinidad and Tobago*, Vol. XIX, 1920, p. 1 ff.

B. H. Jones and F. Carmody, "Cane Farming in British Guiana and Trinidad," *West Indian Bull.*, Vol. 6, 1903, p. 1 ff.

F. Carmody, "Cane Farming in Trinidad," *West Indian Bull.*, Vol. 5, 1902, p. 33 ff.

[16] For further discussion of the problems of education and supervision in a system of cane farming see:

H. Jerningham, "Trinidad and its Future Possibilities," *Royal Colonial Institute Proceedings*, Vol. 32, 1901, pp. 215–236.

Note in the *Proceedings of the Agricultural Society of Trinidad and Tobago*, Vol. XXIII, May 1923, pp. 203–204.

FIGURE 11.—The cacao beans are spread on platforms in the sun to dry. When rain threatens, the corrugated iron roof is pushed over the platform. Note the forest of cacao trees in the background.

lack of the luxuries afforded by the large cities and the prevalence of the mosquito, dangerously malarial.

NATURAL CONDITIONS OF CACAO PRODUCTION

Cacao, like most crops, can be grown under a wide variety of conditions, and with much attention to cultivation it can be made to yield well even when the conditions are far from ideal.[17] However, the optimum physical conditions are decidedly limited. Climatically, cacao is restricted to the rainy low latitudes where there is a rainfall of over 50 inches. The trees require almost constantly moist air, so that winds or sunshine have adverse effects. The wind does not, as commonly stated, blow the pods off the trees; but rather it reduces the humidity and dries out the pods so that they cannot ripen. To avoid the sunshine, cacao estates, especially when they are first planted, are shaded. Cacao thrives best in a deep, well-drained alluvial soil, where a large supply of humus is to be had. Humus, unfortunately, is characteristically lacking in the highly eluviated soils of the rainy tropics where organic matter decays so rapidly that almost none is added to the soil.[18]

There is some question whether such ideal conditions for cacao production exist in Trinidad. Well-drained alluvial soils, rich in organic matter and with the climatic requirements of cacao, must be exceedingly rare in tropical regions. Although modern scientific studies of the soil have not been made in Trinidad outside of parts of the sugar district, the soils of the cacao district, as far as the hasty observations of a reconnaissance survey can be trusted, are chiefly yellow clays, deeply eluviated and containing no humus. Professor Hardy reports a laterite in the valleys of the Northern Range.[19] One of the most pressing needs of the cacao district is a survey of

[17] C. De Verteuil, "Yield of Cacao in Trinidad," *West Indian Bulletin*, Vol. 8, 1907, pp. 141–142.
C. P. Rojas, "Record of the Crops and Yield Obtained on La Providencia and San Antonio Cacao Estates, 1908–1922." Society paper 794, *Proc. of the Agric. Soc. of Trinidad and Tobago*, Vol. 23, May 1923, p. 186.

[18] M. W. Senstius, "The Formation of Soils in Equatorial Regions, with special reference to Java, N. E. I.," Report of the Fifth Annual Meeting of the American Soil Survey Association, *Bull. VI*, Vol. II, p. 155.

[19] Personal conference with Prof. F. Hardy Imperial College of Tropical Agriculture, St. Augustine, Trinidad, B. W. I.

its soils from the modern point of view. If ideal conditions do not exist, some approach to them may be found in parts of the island.

The Northern Mountain Valley Community

Because of the varying surface, soil, and other conditions of the cacao district, four subdivisions or communities may be defined (Fig. 6). The first one, the Northern Mountain Valley Community, includes that portion of the Northern Range south of its main divide, and drained by valleys which lead out to the Port of Spain District, previously described. Here there are a series of flat-floored, bottle-shaped, inner lowlands, separated from the plains to the south of the mountains by narrow antecedent gorges (Fig. 1). East of Port of Spain these valleys are sheltered on all sides by the extremely steep slopes of the mountain ridges, which, to the north, reach elevations of 3,000 feet above sea level. In this area the rainfall is very heavy on the upper slopes, and many streams run torrentially down the forested slopes into the valleys below. West of Port of Spain, on the other hand the valleys cut entirely across the range to the northern coast (Fig. 1),[20] and the rainfall is considerably less (Fig. 2). Fresh soil material is washed into these valleys in the eastern part of the community with every shower. This soil replenishment, in spite of the apparent lack of organic material, together with the steamy humidity of the lowland, makes this community in its eastern part one of the richest cacao areas on the island.

The Montserrat Community

The Montserrat Community occupies the valleys and slopes of the Central Range and the Dissected Plain to the north of it (Fig. 1). The Central Range is an area of moderate relief, but otherwise resembles the Northern Range in its forms. Its valleys are narrow and steep-sided. The heavy rainfall (Fig. 2) supports a luxuriant forest on the upper slopes, and makes the valley bottoms extremely moist. Here the soil is kept constantly immature and relatively unleached due to the rapid accumulation of material from the mountain sides. The Montserrat Community has the reputation of being the richest of all the cacao communities.

The Sangre Grande Community

The Sangre Grande Community is located chiefly in the belt of over 100 inches of rainfall (Fig. 2). The showers which bring the rain to Trinidad, form in this belt about five miles from the east coast and drift off westward over the island. Showers occur in this community, therefore, many times during the day. Near the shore, however, the Trade winds tend to dry the air, so that a forest reserve has been set aside by the government along the immediate coast (Fig. 4) which acts as a wind break. As a result of the heavier rainfall, the soil on the flat lands is apparently more deeply eluviated and leached than elsewhere in Trinidad. A sticky yellow clay is characteristic at the surface.

The Southern Community

The Southern Community occupies parts of the Dissected Plain and the Southern Range (Fig. 1). The relief of the Southern Range is less than that of the Central Range, and not very much greater within the area of this community than the Dissected Plain. The rainfall, too, is lower than in the rest of the Cacao District excepting the western part of the Northern Community (Fig. 2). Since this community has been planted to cacao more recently than the others, and since few large estates exist in it, information as to the character of its soil is even more meagre than elsewhere.

[20] R. J. L. Guppy, "The Growth of Trinidad," *Trans. Royal Canadian Inst.*, Vol. 8, 1905, p. 138.

THE CACAO DISTRICT AS AN EXAMPLE OF MALADJUSTMENT

The Northern Mountain Valley Community and the Montserrat Community were the first to be utilized for cacao. Some of the earliest plantations on the island were set out in the basin-like valleys of the Northern Range, access to the towns along the southern piedmont being easy. Methods, however, were very crude. The trees were permitted to grow almost uncared for, the only labor being spent on the collection of the crop and the preparation of the cacao for shipment. In 1727 a blight attacked the trees, and since cacao was almost the only crop on the island, the planters were ruined.[21] A new influx of colonists some fifty years later again resulted in the cultivation of these abandoned plantations. As the popularity of chocolate as a beverage spread in northern countries, the high prices paid for cacao stimulated a gradual increase in acreage, and new plantations were set out in other less favorable parts of Trinidad. The cacao district spread into the Sangre Grande Community, and later into the Southern Community. Many of the East Indians whose contracts with the sugar estates were completed, elected to take out small holdings of crown land, which was given to them without charge, and plant cacao. The Southern Community more than the others has been developed in this way, as may be seen by a glance at the population map (Fig. 3), or the map of the distribution of East Indians (Fig. 5). There are fewer people in the other communities because the estates are larger and less labor is used.

Thus, under the stimulus of high prices, which continued up to 1920, many lands unsuited by the soil or climatic conditions were planted to cacao. On the large estates all the available land was planted to this, and no other crops were cultivated to distribute the risk. All the lands, whether good or bad; all varieties of tree, whether high yielders or poor yielders; almost any condition in which the trees would grow and with hap-hazard management, brought a speculator's profit. Little wonder, then, that there was no pressure to force a closer adjustment for a more efficient production. The cacao district today includes many lands which because of soil, or climate, or drainage, or other conditions could not in the long run be utilized profitably to produce cacao; and which, therefore, may be returned eventually to forest land, when economic pressure forces localization in the better cacao areas with intensive methods.

[21] L. A. A. De Verteuil, *op. cit.* p. 431.

THE PRESENT CRISIS IN THE CACAO INDUSTRY

Since the peak of high prices in 1920, the cacao prices have fallen so low that even those estates which are clear of debt, efficiently managed, and which are located in naturally favored areas are able scarcely to cover expenses.[22] This great drop in prices is due fundamentally to over-production on the world markets,[23] the result on the one hand of greatly increased production in the Gold Coast of Africa, and on the other, of the greatly decreased consumption of chocolate in Central Europe. In 1920 the excess of production over consumption was 97,500 tons.[24] Although the 1925 crop brought somewhat higher prices, the smallness of the crop has postponed again the return to prosperity.

As a result of low prices many interest-

[22] Cacao prices reported by the Cocoa Planter's Association of Trinidad are as follows (per bag of 112 pounds):

1910–11	$11.47
1913–14	12.76
1919–20	23.90
1920–21	10.00
1921–22	10.96
1922–23	12.22
1923–24	10.26

Correspondence with U. S. Bureau of Foreign and Domestic Commerce, Washington, D. C.

[23] Correspondence with George C. Lee & Co. of New York, Cacao Importers.

[24] W. G. Freeman, "Cacao Production," Society Paper 800, *Proceedings of the Agricultural Society of Trinidad and Tobago*, Vol. 23, Sept.–Oct., 1923, p. 381.

ing changes are taking place in the cacao district. The beginning of a movement, which if continued would result in a closer geographic adjustment, may be seen. Some plantations in the poorer areas are allowed to stand idle, without cultivation or even picking. On many of the larger estates other crops are being introduced to tide over the period of depression. Near Sangre Grande an estate has planted *hevea* rubber as a windbreak on the areas of poorer soil using little or no shade over the cacao plantings. An estate in the Montserrat Community has begun the production of tropical fruits. Other estates are utilizing the coffee from the hedges for more than home consumption. The addition of live stock, too, is proving well worth while. However, the complete lack of scientific information about the cacao district which would make possible an adjustment such as is now being reached in the sugar lands, makes this period all the more serious for the planters and all the more embarrassing for those who should tender advice.

Beside these changes in plantation practices, which are largely haphazard trials many of which will be found in error, there are a number of significant changes in land utilization. Along the margins of the sugar district many cacao planters are cutting off their trees and planting sugar cane instead. In other places, the excellent condition of the coconut market has led cacao planters to change to coconut production. Unfortunately in very many places these changes have been made on poor cacao sites, which are also poor sugar sites, and very bad coconut sites. Thus the changes provide only a temporary relief, and represent a shift from one maladjustment to another. On such poor lands where the owner has but little capital, no other course is apparently open to him.

If the cacao industry is to survive, it must eventually seek to adjust itself more closely to the natural conditions, reducing its acreage, if necessary, to only the better suited lands, and increasing production from these lands by intensive cultivation, by the selection of better cacao varieties, and by more efficient management.

FIGURE 12.—Coconut palms along the eastern shore of Trinidad. The Trade Wind blowing in from the sea makes such a spot delightfully comfortable.

RELATION OF THE CACAO INDUSTRY TO TRINIDAD AS A WHOLE

The economic life of Trinidad is closely related to the cacao industry. Prosperity for the cacao planters means prosperity throughout the colony. Interesting correlations may be worked out between the yield of cacao, and the earnings of merchants, the earnings of the street railway in Port of Spain, the purchase of jewelry, and many other things.[25] The present depression in cacao is reflected in decreased imports, stagnant business conditions, and a general lack of prosperity throughout the island.

THE COCONUT DISTRICTS

The popular conception of a tropical setting is a beach of glistening white sand, rimmed on the landward margin by a myriad of coconut palms, their smooth trunks leaning at perilous angles toward the light, their graceful tops waving in the wind; and half hidden among the palms the thatched huts of the coconut workers (Fig. 12). Such a setting may be found at many points along the shores of Trinidad. The three coconut districts, where the industry has become

[25] Personal conference with Prof. W. R. Dunlop, formerly professor of economics, Imperial College of Tropical Agriculture, Trinidad.

localized, are situated at widely separated points. The Cedros District is at the end of the southwestern peninsula; the Nariva-Mayaro District is stretched along the eastern coast; and the North Coast District occupies the land of marvelous scenery where the ridges of the Northern Range rise abruptly from the Caribbean Sea.

NATURAL CONDITIONS OF COCONUT PRODUCTION

As in the case of cacao, coconuts may be raised under widely varying conditions, but ideal natural conditions are narrowly limited. The most critical factors, aside from the climatic range of coconuts, are soil and drainage. Coconuts are halophytes, that is, they can endure salt water; but they do not require the presence of salt water, for thriving plantations can be grown many miles from the sea.[26] Drainage, however, must be rapid and constant, for a large supply of water must be readily available for the root of the palm, although stagnant water, even for short periods, is very harmful. Under these conditions, a sandy soil, rich in organic matter if possible, but at any rate easily permeable by the currents of ground water, is essential. Coconuts do poorly on clay soils.[27] The combination of sandy soil and a constant flow of ground water is most commonly found along the sea coast especially where the land rises behind. This explains the common but erroneous impression that coconuts must be grown close to salt water.

Three such areas are found in Trinidad.[28] The Nariva Beach in the Nariva-Mayaro District is the best suited by physical conditions for coconut production, for here a long sand bar has been built across the sea face of the Nariva Swamp (Fig. 1). The waters from the swamp, laden with organic material, seep continuously through the sand of the bar imparting a rich black color to the sandy soil, and creating a condition as close to ideal as could be desired. A similar situation exists in Cedros, although here the drainage area is smaller, and consequently the effects of deficient rainfall may become critical. The North Coast District is located chiefly along a marine terrace, about 100 feet above the sea, and backed by the slopes of the Northern Range. Drainage conditions are suitable, and the soil on the terrace is a black sandy loam.

THE LOCALIZATION OF THE COCONUT INDUSTRY

The Cocal, located on the Nariva Beach, was the first coconut plantation in Trinidad. Apparently it was a natural growth, palms springing up from coconuts washed ashore nearby from an old wreck. Relatively recently in the history of the island, coconuts have become important, so that the estates are, most of them, fairly new. We have already seen that coconuts replaced the sugar fields in Cedros about 1900. The north coast has been developed even more recently. Thus, early in the history of the coconut industry, the three best-suited areas have become the three coconut districts.

THE RELATION OF COCONUTS TO OTHER CROPS

Because the coconut districts of Trinidad are all exposed to drying winds, cacao does not compete for the use of the land in these areas. Sugar, too, is excluded from the coconut districts by too much rain and wind, and by the isolated character of the northern, eastern, and southern shores. Thus coconuts can develop unopposed by other crops within these areas. However, many coconut plantations are now being set out within

[26] F. Stell, "Some Notes on the Agricultural Requirements of Coconuts," Society Paper 793, *Proceedings of the Agricultural Society of Trinidad and Tobago*, Vol. 23, April, 1923, p. 131.

[27] A. Fanchere, "The Soil in Coconut Cultivation," *Bull. of Misc. Information*, Trinidad Botanical Department, Port of Spain, 1908, pp. 21–24.

[28] P. E. James, "Geographic Factors in the Trinidad Coconut Industry," ECONOMIC GEOGRAPHY, Vol. II, No. I, pp. 108–125, 1925.

the cacao district, and many are scattered throughout the sugar district (Fig. 4). Most of these coconut plantings are on low-grade coconut land, where the soil is a sticky clay, or where drainage is not suitable. Examples of this are the groves just outside of Port of Spain along the railroad which runs eastward; or the extensive plantations in the Diego Martin Valley, west of Port of Spain. In the sugar district some of these plantings are designed primarily as cover crops for land which is idle due to the scarcity of labor. But where coconuts are planted as a speculation due to high coconut prices which now prevail, and are located on poor coconut land, they represent cases of maladjustment. Of course, high rewards may be won from such plantations; but the rewards are speculative and the plantations in the long run cannot be considered as an investment.

ADJUSTMENTS WITHIN THE COCONUT DISTRICTS

The Cedros District has become the largest producer of coconuts on the island. Of the three possible coconut products, whole nuts, copra, and oil, Cedros ships the largest amount of whole nuts. This is due to the ease of handling whole nuts across the calm waters of the Paria Gulf in lighters; for the handling of whole coconuts in rough waters or on trains results in many losses due to breakage. Nariva-Mayaro and North Coast ship copra almost entirely. In the drying of the copra, Cedros and North Coast spread the coconut meat in the sunshine but the Cocal with its heavier rainfall (Fig. 2) and greater cloudiness uses a steam-drying process.

An interesting relation between favorable natural conditions and human activity may be seen in the three districts. Cedros and North Coast spend considerably larger sums of money on cultivation than does the Cocal.[29] This is partially due to the slightly more adverse conditions in those districts than along Nariva Beach. By attention to cultivation, however, the Cedros District has become the chief producer of coconuts on the island. At the Cocal, very little attention is paid to cultivation. Instead of returning the coconut husks to the soil as fertilizer, they are used as fuel in the copra drying plant. Here soil fertility is constantly replenished by the seepage from the Nariva Swamp. With cultivation the Cocal might be made to double its yield—but why should the owner go to this trouble when returns are already very large, and when he has many other interests in other parts of the island? Eventually perhaps, the Cocal will be one of those highly favorable areas where the industry will concentrate with intensive methods.

FIGURE 13.—Sharp crest ridges of the Northern Range, with steep concave slopes, resulting from rapid uplift, and vigorous stream erosion. Crossing such divides is difficult.

THE NORTHERN RANGE PEASANT PROPRIETOR DISTRICT

This district lies north of the main ridge of the Northern Range, excepting in the east where it reaches the southern piedmont of the mountains in the belt of very heavy rainfall (Fig. 6). The rapid cutting of streams in mountain

[29] W. Grieg, "The Coconut Industry of Trinidad," *West Indian Bull.*, Vol. 6, 1905, p. 149.

areas where heavy tropical rains provide an abundance of water results in steeper slopes than are common under the more familiar conditions in Middle Latitudes. The valleys are narrow, with oversteep sides, and the divides, instead of being rounded, culminate in sharp knife-edges (Fig. 13). The rounded hills common to maturity of the erosion cycle in mid latitudes are dissected into narrow ridges, somewhat similar to glacial arêtes. Communication through such mountain areas is extremely difficult owing to the steepness of the slopes to be climbed, the tangle of vegetation to be encountered, and the frequency of landslides on the soft, decomposed, water-soaked surface. Thus the development of this district has been hampered by difficult accessibility. Along the immediate coast, where the steamers can provide relatively easy transportation to Port of Spain, the coconut district previously described has been established.

The Northern Range is made up of a series of roughly east-west fault ridges.[30] North of the main ridge there are three other ridges progressively lower towards the north; and between these ridges there are small lowland areas, receiving abundant rainfall (Fig. 2), sheltered from the winds, and probably possessing as fertile a cacao soil as can be found on the island.

LAND HOLDINGS

The land holdings throughout this district are characteristically small. Most of them are held by peasant proprietors, either East Indians or negroes. Only along the embayed section of the coast in the western part of the district (Fig. 6) are there any larger estates. At the heads of these bays some coconuts are grown, and in the steamy valleys some cacao estates have been set out (Fig. 4). The rest of the district is largely waste land or forest reserve, with peasant holdings scattered here and there in small isolated units. Tramping through the forest one comes upon these holdings suddenly. The property generally includes the side of a valley, extending from the lower boundary of the forest reserve (Fig. 4) to the stream in the valley bottom. The lower slopes in the rain-soaked valleys are planted to cacao; the upper slopes are cleared of forest and planted to corn—on slopes so steep that one can scarcely climb without aid of the hands. The uncleared forest reserve above seems to hang out over these small holdings like an eyebrow, a term so picturesquely applied to the forests in eastern Bolivia. Between the corn and the cacao, on the mid-slopes the peasant proprietor builds his hut, the walls of mud reënforced by sticks, the roof of thatch from the *timit* palm (Fig. 14). Around the hut within a few feet of the door, are some pepper bushes and fruit trees; and nearby a small vegetable patch is used to raise food for the family.

[30] R. J. L. Guppy, *op. cit.*

THE PEASANT PROPRIETORS

Cacao plantations of this sort represent a response to high market prices, and to favorable yields with little cultivation. The drop in cacao prices since 1920 has taken from these people their only money crop. However, the returns on cacao provided luxuries for the peasant proprietors rather than necessities. Trips to Port of Spain are indulged in less frequently than formerly, and the peasants maintain themselves on their estates, exchanging corn, mangoes, or avocados for those few things which they cannot produce themselves, such as calico (Fig. 15).

THE FOREST RESERVES

In the mountain areas of Trinidad, and especially in the areas of high relief, the protection of the watersheds by forests is essential. Rapid erosion results from cleared slopes—tremendous floods after each cloudburst in the mountains bringing great quantities of gravel into the valleys, and then, in drier times, perhaps even a scarcity of water. The Trinidad government has done well to establish many forest reserves along the watersheds, and on some of the poorer

FIGURE 14.—Small land owner's hut in the Northern Range, surrounded by a tangle of fruit trees, pepper bushes, and vegetable crops.

soil areas of the lowlands.[31] Also, as previously mentioned, some forests are maintained as wind-breaks for the cacao district. In these forests are many valuable tropical timbers, including West Indian Cedar and Mora. Trinidad exports about 152,000 cubic feet per year of Cedar.[32] Only a part of this, however, comes from this district.

THE SOUTHEASTERN UNDEVELOPED DISTRICT

The southeastern part of Trinidad is little developed, having a sparse population (Fig. 3) and much unused land (Fig. 4). In this area some of the virgin "highwoods" still remain such as were so vividly described by Kingsley.[33] The undeveloped character of this district results in part from its location, which, being so far removed from Port of Spain is naturally the last part of the island to be settled. But in addition to this, some of its surface is swampy (Fig. 1), and some of it is rough. The soil, according to the early geologic survey of the island, is sandy and infertile,[34] occupied largely by the Mora tree which is supposed to be found only on poor soil areas. Probably this part of the island could best be used for timber production.

PITCH LAKE AND OILFIELDS DISTRICT

The Pitch Lake and Oilfields District is altogether different in character from any of the other Trinidad districts.[35] Here one finds the bustle and routine activity of an oilfield. In great contrast to the surrounding parts of rural Trinidad, are the neat lawns and white painted buildings of the Asphalt company's "camp" at Brighton (Fig. 1). The condition of the cacao crop is less important here than in the rest of Trinidad. The dominant interest is efficient oil or asphalt production; not the country in which these resources are found.

PITCH LAKE

The Pitch Lake (Fig. 16) is located a short distance from the Paria Gulf in southern Trinidad (Fig. 4). This is the world's chief source of natural asphalt, which, because of the uniform quality of the lake, has become the standard by

[31] R. C. Marshall, "Forestry and Agriculture: The Allocation of Land," *Tropical Agriculture*, Vol. II, April 1925, p. 70.

[32] R. Zon and W. N. Sparhawk, "Forest Resources of the World," New York, 1923, Vol. II, p. 624.

[33] C. Kingsley, *op. cit.*, Chapter VII.

[34] G. P. Wall and J. G. Sawkins, "Report on the Geology of Trinidad," London, 1860, p. 77.

[35] The following references deal with the oil and asphalt resources of Trinidad:

Handbook of Trinidad and Tobago, Government Printing Office, Port of Spain, Trinidad, 1924, pp. 52–66.

W. O. Crosby, "Notes on the Physical Geography and the Geology of Trinidad," *Proc. Boston Soc. of Natural History*, Vol. 20, 1878, pp. 44–45.

W. P. Pierce, "Asphalt of Trinidad," U. S. 52nd Congress, 2nd Session, House Misc. Documents No. 108, Series 3127, Consular Report 145, October 1892.

C. Craig, "The Oil Fields of Trinidad," *Proc. of the Royal Colonial Institute*, Vol. 37, 1906, pp. 340–355.

J. Cadman, "Mineral Resources of Trinidad," *Inst. of Mining Engineers Transactions*, Vol. 35, 1908, pp. 453–480.

A. B. Thompson, "The Oil Fields of Trinidad," *Red Book of the West Indies*, London, 1922, p. 172.

H. D. Baker, "The Asphalt Lakes of Trinidad and Venezuela," *Am. Consular Bull.*, July 1923, p. 195.

P. E. James, "The Pitch Lake, Trinidad," *Journal of Geography*, Vol. 24, 1925, pp. 212–220.

FIGURE 15.—Family of East Indians—free peasant proprietors in the Northern Range—on the trail to Port of Spain. Shoes are commonly carried, to be worn in the city.

which other asphalts are measured. This unusually rich resource has made possible expenses in its development unusual in mining camps. Brighton has a more permanent air than most similar towns. Sanitation measures have been carried out which could be supported only by the taxes in a large city, or by the revenue from such a monopoly product as asphalt. Malaria, which is unfortunately very prevalent in the agricultural parts of Trinidad, is practically unheard of here. A large refinery has been built near the lake, in which the pitch is heated to drive off the water. From there the pitch is carried to Brighton pier on a cable line, and loaded directly on ships which, in the calm waters of the Gulf, can tie up at the end of the pier, a third of a mile from shore.

Negroes, who are physically stronger than the East Indians, are used almost

FIGURE 16.—The Pitch Lake. In the background the derricks of a neighboring oilfield may be seen. After a shower, pools of water accumulate on the surface of the pitch, and these must be pumped dry before the fever-carrying mosquito can breed in them.

exclusively as labor; and many Trinidadians are employed in the offices. The laborers are paid very high wages as compared with those in the agricultural districts, and are given neat, clean homes to live in; in return for which steady, earnest work is required.

THE OILFIELDS

The oilfields of Trinidad are as yet only partially developed. The chief fields are located south of Pitch Lake (Fig. 17), within this district; but a few other fields are being worked. One is located along the southern flanks of the Central Range in the central part of the island. Another is along the southern margin of the sugar district in the Oropuche Swamp. A third is just being opened up along the coast in southeastern Trinidad. Oil probably exists under the greater part of Trinidad south of the Central Range, and oil derricks are common sights in this area. Where oil is struck in quantities to support a field,

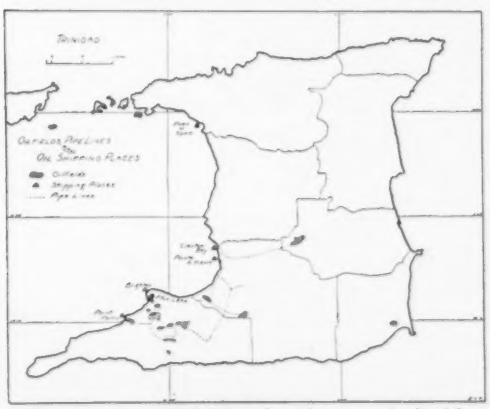


FIGURE 17.—Oilfields, pipe lines, and oil shipping places in 1923.

the agriculture of the area declines as the workers flock into the oil industry.

Part of the oil is shipped in a crude state, but a large part of it (42 per cent in 1922) is refined in Trinidad. Refineries are located along the coast just north of San Fernando, and the petroleum is sent to this point from the oilfields in pipe lines. With the development of new fields this industry will probably employ an increasing number of people.

THE RELATION OF PITCH LAKE AND OIL FIELDS TO THE REST OF TRINIDAD

Unfortunately, many of the developments resulting from the exploitation of oil must be considered as purely temporary. When the oil is exhausted, there will no longer be refineries or oil camps. From an agricultural point of view, the chief hope is that the land will not be soaked in petroleum and ruined. On the other hand, the oilfields, and especially the more permanent asphalt lake (which is estimated to have a reserve for 400 years at present rates of production) attract to Trinidad much capital which otherwise would seek other fields. The access to markets given by direct shipping connections with the Middle Latitude countries is of no small importance. A special line of steamers is supported largely by cargoes of asphalt, running between New York and Trinidad, and on to British Guiana. Without the asphalt, such an intimate connection would be impossible. Furthermore, many of the steamers returning northward from South American ports, stop at Trinidad to take on a cargo of asphalt, again furnishing a close contact with the world trade routes. The influence of these steamers and of the engineers and managers who come to Trinidad, on the life and progress of the island as a whole, can scarcely be over-emphasized.

The local use of the asphalt and oil is also considerable. Trinidad owes its unusually fine development of automobile roads, which reach almost all parts of the colony, to the cheap surfacing material close at hand. Petroleum, too, is used extensively as a fuel; a fact which results in a very low per capita consumption of firewood in Trinidad as compared with neighboring countries.[36]

TRINIDAD AS A WHOLE

RELATION TO THE GUIANA COASTAL REGION

Trinidad is a sub-region within the major geographic region which includes

[36] R. Zon and W. N. Sparhawk, *op. cit.*, p. 625.

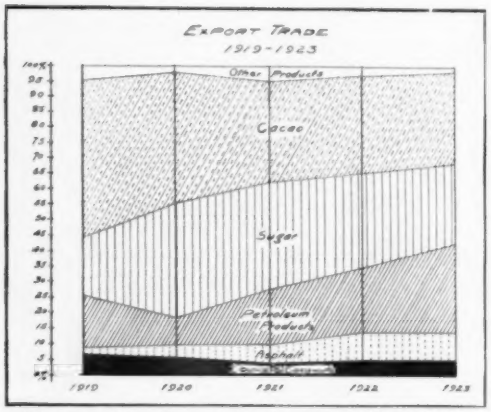


FIGURE 18.—Export trade of Trinidad, 1919–1923.

the Guiana Coast and the Orinoco Delta. It resembles the rest of the region in the broad similarity of its natural and cultural features; but it may be separated as a sub-region on the basis of (1) its strategic insular location which gives it a commanding position in relation to the Orinoco Llanos while at the same time it has a small but important physical separation from the South American continent; and (2) because of its oil and asphalt.

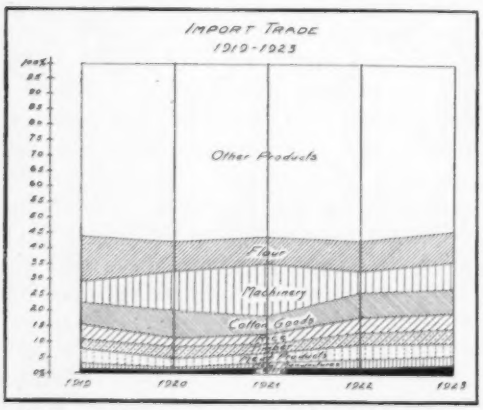


FIGURE 19.—Import trade of Trinidad, 1919–1923.

RELATION TO THE REST OF THE WORLD

The colony has a foreign trade which amounted in 1923 to some eight million pounds.[37] Five articles make up 97 per cent of the exports, these being cacao, sugar, petroleum products, asphalt, and coconut products. The graph (Fig. 18) shows the trends of these products during the five-year period 1919 to 1923.

The imports are highly diversified, the first five articles making up only 37 per cent of the total. The more important imports include flour, machinery, cotton goods, rice, timber, and meat products. These are shown in the second graph (Fig. 19).

The exports of the colony before the war went in large part to the United States. Since the war, however, United States has dropped, largely due to the decreased value of cacao, and the United Kingdom is now in first place. Of the imports, the United Kingdom is the chief source, with the United States and Canada following closely.[38]

Trinidad also carries on an important transit trade for the Orinoco Llanos, which trade amounted to over £500,000 in 1923.[39]

CONCLUSION

STAGES IN ADJUSTMENT

The settlement and development of Trinidad has proceeded in three stages of adjustment to the natural conditions. Each of the major districts of the island represents a slightly different point in the succession. The first stage is characterized by a haphazard, extensive use of the more accessible high-grade sites.

[37] Trade statistics from Report of the Collector of Customs, *loc. cit.*

[38] In 1913, the U. S. took 45.4% of the exports, and the United Kingdom took 16.2%. The exports to the United States included 82% of the asphalt; 60% of the cacao; 86% of the coconut products; and 82% of the petroleum products. The U. K. took 90% of the sugar.

In 1923 the U. S. took 23% of the exports, and the U. K. took 46%. The U. S. took 47% of both the cacao and the asphalt, while the U. K. took 61% of the coconut products; 68% of the petroleum products; and together with other British possessions took practically all of the sugar.

Of the imports, the U. K. sent 31.6% in 1913 and 30% in 1923; the U. S. sent 29% in 1913 and 25% in 1923. In the latter year Canada sent 20% of the imports.

[39] P. E. James, "The Possibilities of Cattle Producton in Venezuela, *Bull. Geogr. Soc. of Phila.*, Vol. 22, April 1924, p. 17.

Thus the early cacao plantations were located on first-class cacao land, as such lands go in Trinidad. The early sugar plantations around San Fernando were located in the best sugar community of the island. The localization of the coconut plantations in the three best coconut areas is a more recent indication that this industry, also, is to pass through this early first stage of adjustment. The extensive use of the Cocal is typical. But cacao and sugar have passed out of this stage, and now the coconut industry is also entering the second stage.

This second stage is characterized by a complete loss of harmony between cultural and natural forms, when, under the stimulus of prosperity and cheap land, crops are grown on new sites which are relatively low grade. Because these lands are inexpensive, and because, being virgin they still possess some soil richness, it is possible to make considerable profit off them. In fact this stage is usually one of great prosperity. Sugar at one time had spread thus to most parts of the island; cacao today is greatly over-expanded; and coconuts are beginning to lose the early harmony of their adjustment in their spread to other parts of Trinidad. However, sugar has passed through this stage, and cacao is in the agony of transition.

The third stage is characterized by a renewed harmony between the cultural and natural forms. The better sites are used, and intensive cultivation requiring large capital and labor investments increases the efficiency of production. Scientific studies are made of the land, and varieties of crops well adapted to the varying conditions are selected. In theory the end stage would be reached when every plat of land is used as efficiently as possible to produce those things for which it is best adapted. Actually, however, such close adjustment may be interrupted by the invention of machines, the spread of crop pests, the ravages of war or political over-turns, or by the many natural and human events which change the normal courses of things.

In Trinidad, only the sugar district has entered this stage, and even in the sugar district, adjustment is far from perfect.

THE FUTURE OF TRINIDAD

The cacao and coconut industries will probably follow the lead of the sugar industry in establishing sooner or later a closer geographic adjustment. Without a fuller knowledge of the soil, drainage, and other critical forms of the island, the trend toward closer harmony must necessarily be uncertain and groping in its direction. A systematic land classification is the only substitute for inefficient trial and error. With a stable government, rich resources, varied natural conditions which lead to varied industries and consequent economic security, and with an energetic and progressive people, Trinidad should be well able to take advantage of the increasing demand for the tropical products which can, to such advantage, be grown there.

GEOGRAPHIC ASPECTS OF THE PRINCE EDWARD ISLAND FUR INDUSTRY

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University of Michigan

PRINCE EDWARD ISLAND is the home of many fur farmers. The high degree of specialization and the recent expansion of the fur industry on this island is phenomenal. In 1923, the provincial reports show that 100 per cent of the fur farms produce foxes exclusively, that 96.8 per cent of the foxes born on the farms were silver-black foxes from superior strains of registered stock, and that the number of farms had increased 77.7 per cent during the past five years.* This prosperous cash animal-crop industry has done much to relieve the industrial stagnation which has been evident on the island since the passing of a profitable lumber and ship-building industry.

Critical Natural Conditions of the Fox-Farming Industry

The Province of Prince Edward Island leads the world in the production of silver-black foxes. Natural forms of the landscape are of much consequence to the successful development of this fur-farming industry.

CLIMATE

The climate of Prince Edward Island is of the Siberia, or Severe Winter Continental, Type. The climatic data here given are based on weather observations taken at Charlottetown, Prince Edward Island, over a period of 33 years.[1] The average rainfall which varies but little throughout the island because of the marine position, the low altitude, and low relief, is 39.27 inches. The average snowfall is 83 inches (8.3 inches of rainfall) of which 98.6 per cent falls during the months from November 1 to April 30 (Fig. 3). The mean annual temperature is 42° F. The mean maximum and mean minimum temperatures are for July, 74° F., and 58° F.; and for February, 26° F., and 9° F. respectively. The absolute minimum temperature is –23° F. The summers are cool and short with a mean temperature of 66° F. for July, while the winters are long and severe with a mean temperature of 18° F. for February. The island is rather free from damp foggy weather because Newfoundland and Cape Breton Island prevent the cold Labrador current from coming in contact with the warmer waters of the Gulf of St. Lawrence.

THE SEACOAST

Prince Edward Island possesses a tremendous amount of seacoast in comparison to its area. This is largely due to a highly embayed coast with many estuaries resulting from numerous drowned river valleys, and the shallow bays formed in the drowned basins which were carved out between the more resistant rocks on the adjacent headlands by the Pleistocene glaciers. The island is so attenuated and indented along the margin that no point is over 15 miles from the sea (Fig. 1). The sea is under 25 fathoms in depth from approximately 8 to 25 miles off-shore in any direction. Large amounts of sea food are obtained from these shallow waters.[2] The splen-

* The statistics pertaining to fox farms used in this article include only the larger farms which are registered with the Canadian Silver Fox Breeders' Association, or the Prince Edward Island Fox Breeders' Association. The many small non-registered farms are relatively insignificant.

[1] Sir Frederick Stupart, Director of the Meteorological Service of Canada, Toronto, Ontario, Canada.

[2] Dominion Bureau of Statistics, *Fisheries Statistics of Canada*, 1924, Ottawa, Ontario, Canada, pp. 42, 43.

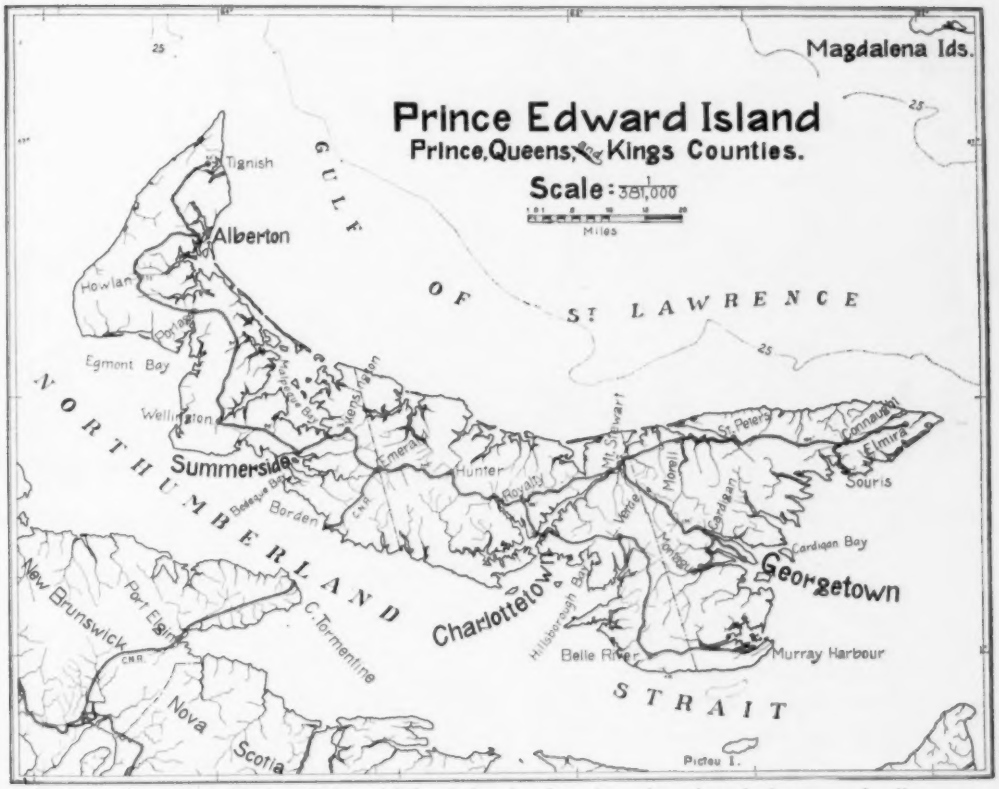

FIGURE. 1.—Map of Prince Edward Island showing location, elevation, drainage, and railway connections with the mainland.

did harbors and rare off-shore fishing grounds have attracted many people to the coast where the location of fox farms is most feasible.

OTHER NATURAL FORMS

Other landscape forms pertaining to fur farming in Prince Edward Island can be briefly described. The land surface of the island is gently rolling with the typical hummocky glacial topography which affords many good exposures on the gentle south-facing slopes (Fig. 2). The drainage on the slopes and in the loamy soils is good. There is some clay in the subsurface horizons of the soil profile, and on the higher hills a rather heavy clay is often found at the surface. The lower layers of the soil profile are almost universally compact and are filled with many irregular fragments of parent red sandstone together with some small rounded pebbles of glacial origin. A thick stand of conifers intermingled with groups of deciduous trees formed the virgin forest cover.[3] Wild foxes were plentiful in the forest before the island was largely denuded of its magnificant forest cover. These foxes reached the island on the ice flows of Northumberland Strait centuries before man inhabited the area, or at the time when the island may have been connected with the mainland.

The texture and structure of many Prince Edward Island soils favor fox-farm constructions. A great economy in fence construction is realized on a farm with compact, stony subsurface horizons in the soil profile. The fence need not enter the ground more than 6 to 12 inches, while if the subsurface horizons are medium in texture and friable the

[3] Heaton's *Commercial Handbook of Canada*, 1924, Part III, Heaton's Agency, Toronto, Ontario, Canada, p. 478.

FIGURE. 2.—A typical landscape View of Prince Edward Island which is truly a garden spot in the Maritime Province Region of Canada. Eighty-seven per cent of the total area is in farms with sixty-three per cent of the farm land improved. Note the glacial topography, and the well-distributed farmsteads. (Courtesy of Canadian National Railway.)

fence is extended into the ground 4 or 5 feet, and turned inward a foot at the bottom in order to prevent the animal from burrowing out.

CULTURAL FORMS OF THE LANDSCAPE

The slightly isolated location of Prince Edward Island is somewhat disadvantageous to its welfare. The isolation has been diminished somewhat since 1917 through the establishment of car ferry service with the mainland over the Canadian National Railway, and through the addition of a third rail to a large part of the island's narrow gauge railway making it available to accommodate standard gauge rolling stock. The lack of ample means of communication together with the isolated location stimulated early coöperation among the island people. All important industries have long since been thoroughly organized in order to advance their interests, and to carry on coöperative bargaining in the sale of their produce and the purchase of their supplies. The Prince Edward Island Fox Breeders' Association, Potato Growers' Association, Ayrshire Association, and many others are typical examples.[4] The island is off the main trade routes of the Gulf of St. Lawrence, but direct boat line communications are maintained during the summer months with a few ports in the United States and Canada.

Prince Edward Island is often called "The Garden of the St. Lawrence." The island merits well this title from its agricultural setting and productivity. The area in occupied farms amounts to 87 per cent of the total land area, and 63 per cent of the farm land is improved.[5] An abundance of live stock, poultry, cereals, and vegetables are annually raised on these farm lands. The fox farm is an integral part of many general farms (Fig. 4). Many farmers own a small ranch with two or three breeding pairs of foxes. The breeding of foxes is

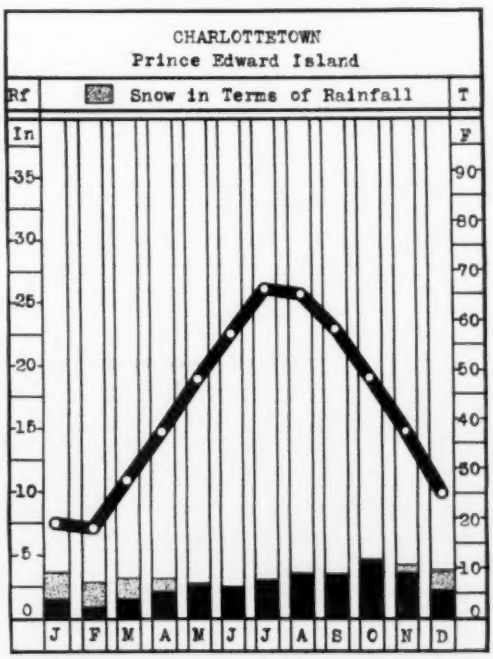

FIGURE. 3.—Climatic Chart showing the mean annual rainfall, snow in terms of rainfall, and the mean annual temperature for Charlottetown, Prince Edward Island.

[4] Department of Agriculture, *Annual Report for Prince Edward Island*, 1923, Summerside, Prince Edward Island, pp. 25, 76.

[5] "Sixth Census of Canada, Census of Agriculture," Prince Edward Island, *Bulletin No. 2*, Ottawa, Canada, p. 4.

FIGURE. 4.—Many of the Prince Edward Island fox farms are an adjunct to the agricultural economy. This farmer has failed to recognize the importance of trees about the ranch. Notice the lookout gable on the building in the foreground. Isolation pens and pelting run can be seen in the right foreground. (Courtesy of Canadian National Railway.)

a new phase of animal production which is closely related to general farming.

Specialization in fox production is of paramount importance. Since large amounts of capital are required to equip a modern fur farm, many of the larger farms are organized as partnerships, or as stock companies. The island has 142 farms of this type of organization. The average capital investment for all fur farms on the island is $7,770 per farm.[6] This is an average outlay of $260 per fox for land and equipment. About 225 farms board foxes which are owned by capitalists who have no interest in the farm equipment.

FIGURE 5.—New type of ranch built by W. K. Rogers, who is the largest individual breeder of silver foxes in the world. This ranch is a short distance southeast of Charlottetown, Prince Edward Island.

[6] Dominion Bureau of Statistics, *Report on the Fur Farms of Canada*, 1923, Ottawa, Canada, pp. 10–11.

DISTRIBUTION OF POPULATION

The large agglomerations of population in Prince Edward Island occur almost entirely along the coast. The largest urban center is Charlottetown, a city of 12,347 people.[7] This small city, located at the confluence of three rivers which were widened by the drowning of large valleys, has one of the finest natural harbors in North America. The development and growth of this city was largely due to the presence of the natural harbor in a central position on the mainland side of the island, where three rivers formed easy routes to the interior with Hillsborough River extending to within a few miles of the north shore. Other cities and villages are found along the shore. Summerside with a population of 3,228 people is located nearest the mainland. Alberton occupies an important position in relation to the north shore fisheries. Souris, Georgetown, and Montague are

[7] "Sixth Census of Canada," Volume I, Population, Ottawa, Canada, p. 12.

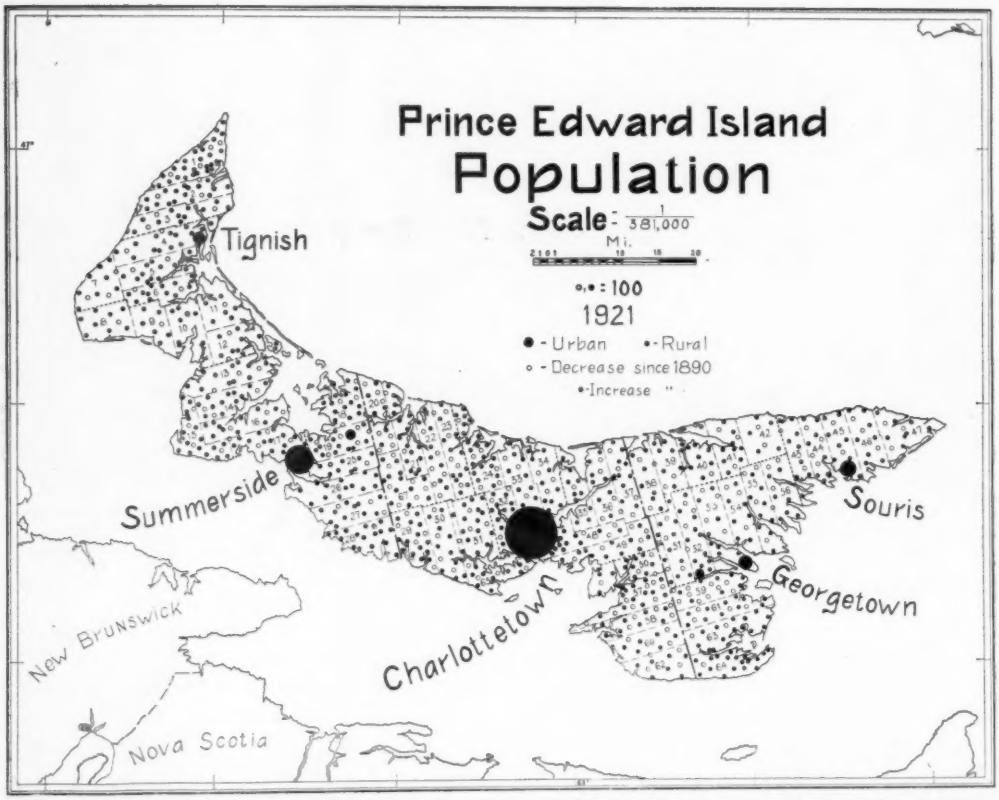

FIGURE 6.—Population map of Prince Edward Island showing the distribution of rural and urban population. Nearly all of the urban agglomerations are found at the coast. The rather even distribution of rural population is outstanding. All townships, except two, show a decrease in rural population since the passing of the lumber and shipbuilding industry.

located on the east shore (Figs. 1, 6). Kensington is the only inland village with more than 500 people. Small agglomerations of rural people can be found at frequent intervals. These are typical rural settlements, a few families grouped about a store, a church, a cheese factory, a blacksmith shop, or, if along the shore, a lobster cannery.

LANDSCAPE FORMS RESULTING FROM FOX-FARMING INDUSTRY

The landscape of Prince Edward Island contains several cultural forms which are characteristic of fox-farming districts.

DISTRIBUTION OF FOX FARMS

The distribution of fox farms on Prince Edward Island bears a close relation to the distribution of population and the seacoast. Certainly the climate does not function materially in this regard because climate is nearly uniform throughout the island. It is true that climate favors fox farming on the island, but it shows little relation to areal distribution. To a lesser extent the same can be said of land surface, drainage, soils, and vegetation, which have a rather uni-

FIGURE 7.—Many ranches on Prince Edward Island are surrounded by a high board fence to keep the snow from drifting during the winter.

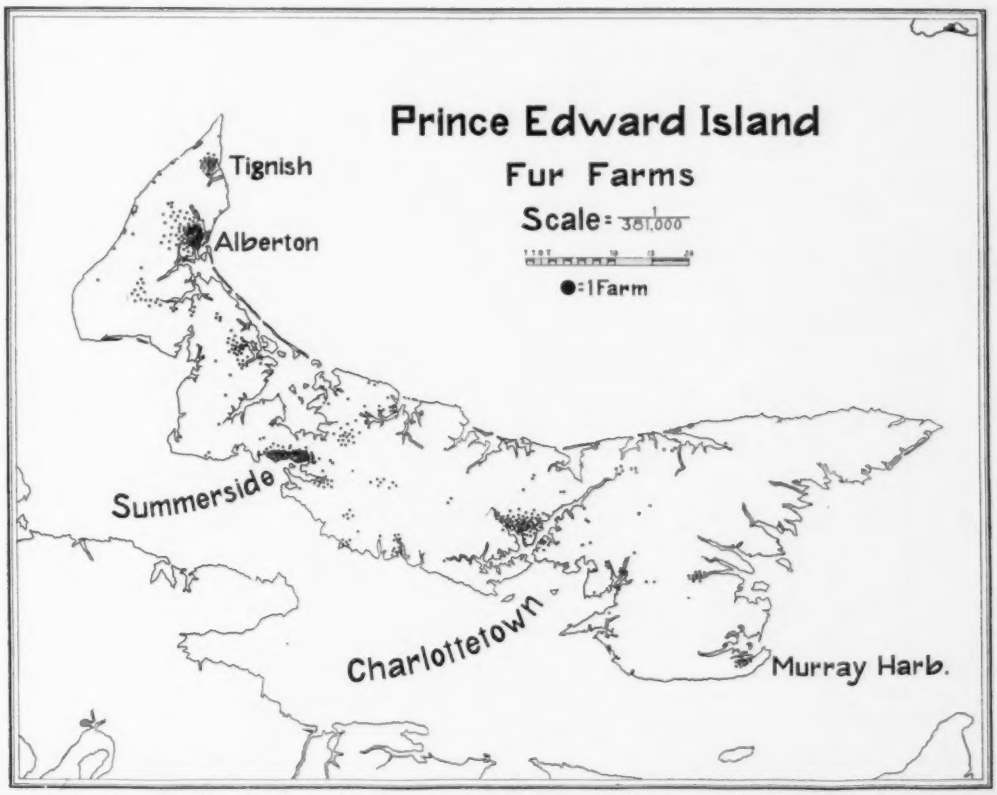

FIGURE 8.—The distribution of fox farms on Prince Edward Island. Notice the great concentration about the larger towns and cities. The industry continues to advance eastward from Tignish where the first successful farm was established in 1894. Prince Edward Island has more than 1,000 fox farms, but no records are available to show the location of the small non-association owners.

form favorable distribution, and which are closely related to the industry locally.

The fox farms of Prince Edward Island are almost all located near population agglomerations. Near Tignish where the industry took root there are 21 farms,[8] Alberton has 49 farms in the nearby rural sections, Summerside has 63, Charlottetown 52, Kensington 18, and Murray Harbour 10. Some farms are grouped about the smaller villages of the province (Fig. 8). A fur farm with eight or ten breeding foxes requires a capital investment of more than $10,000; fresh supplies of easily accessible food, especially fish, offal, meat, milk, cereals, vegetables, and fox biscuit; immediate veterinary service; a small amount of highly skilled labor; and only small parcels of land. Capital and labor are mobile; that is to say, these economic factors will flow into favorable areas on demand and are relatively unimportant in the consideration of areal distribution. Obviously, all of the remaining requirements call for localization of the fox-farming industry in the rural sections surrounding centers of population which are relatively close to the sea. In this type of location the obligatory services pertaining to fox farming can be most quickly and cheaply performed.

It has been pointed out that large agglomerations of population are found at the seacoast. The sheltered natural harbors, the excellent fishing in the shallow waters along the shore, and the need of communication with the outside world have all functioned in the areal distribution of both population and fox

[8] Dominion Bureau of Statistics, *op. cit.*, pp. 25–32.

farms. A total of 399 farms (89 per cent) are located near large agglomerations of population at the seacoast where direct communication can be had with the mainland. A total of 36 farms (8 per cent) are located near points of small population along the coast not having direct communication with the mainland, and 13 farms (3 per cent) are near points with small population having direct communication, but rather remote

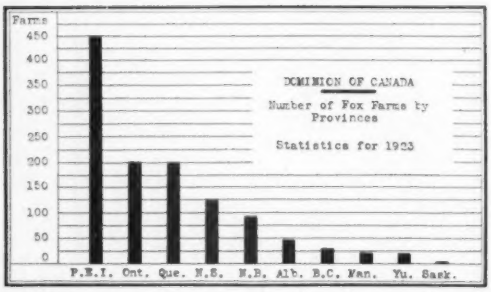

FIGURE 9.—Diagram showing the number of fox farms in Canada by provinces. Prince Edward Island has an average of one farm for each five square miles of surface, while Ontario, her nearest rival, has one fox farm for each 3,454 square miles of surface.

from the coast. Only 3 per cent of the farms are more than four miles from the coast (Fig. 8). Since sea food is one of the important parts of the fox diet and since a large centralized cold storage plant is essential for preserving fox meat, it is quite true that the sea and coast has performed an important function in the phenomenon of the areal distribution of fox farms.

Expansion of the Industry

The expansion of the fur industry in Prince Edward Island has been phenomenal. The first successful farm operations appeared in Prince County in 1894. By 1913 there were 277 farms operating on the island.[9] Largely due to financial difficulties during the World War, the number of farms decreased to 252 in 1919. A steady expansion followed, however, until a total of 448 farms had been registered by 1923 (Fig. 14). The secretary of the Canadian Fox Breeders' Association estimated the total number of fox farms to be well over 1,000. The registered farms comprise the great bulk of the industry. It is easy to see how the industry spread eastward from Tignish as a starting point. The expansion has been greatest in Prince County, the Western division of the island. In 1923, Prince County had 291 farms, or 65 per cent of the total. Queens County immediately to the east had 129 farms, while Kings County on the east side of the island had but 28 farms, or 6.5 per cent of the total (Fig. 8). But few farms are found along the east coast. The people along these protected estuaries are engaged in the fishing industry as a primary occupation and have not yet turned their attention to this more skillful business. Also, general farming conditions are not too good in Kings County and most of the farmers have not been able to finance a ranching project. Further expansion of the industry in Kings County is not anticipated under present conditions.

A Typical Fox Farm

The modern fox farm with its fox houses, pens, and intervening alleys has the appearance of a village. The essential equipment of a typical fox farm consists of pens, guard fences, fox kennels, pelting runs, observation tower, meat house, and hospital or isolation pens. The fox kennel consists of a well-ventilated den about 20 inches square with double walls. Some insulating material such as sawdust is placed between the walls to make the temperature of the interior more nearly uniform. Sometimes a barrel is buried in a larger box containing sawdust, leaving a small opening in the top of the barrel exposed to provide ventilation. The fox can sleep comfortably in this den during the extreme temperatures of summer and winter. The modern fox home is a good reproduction of the hollow log or the underground den of the wild fox. The den is connected

[9] Ned Dearborn, "Silver Fox Farming in Eastern North America," U. S. Dept. of Agriculture, *Bulletin No. 301*, Washington, D. C., p. 5.

to the outer chamber of the kennel with a short chute. A much longer chute run connects the outer chamber of the fox kennel with the pen which is the wire enclosure surrounding the fox home. Rows of adjacent pens are separated by convenient alleyways. The entire farm is surrounded by a guard fence which has an inward projection at the top called the overhang. The height of the guard fence on a fox farm is regulated from the depth of the snowfall. In Prince Edward Island the usual height of the guard fence is 9 or 10 feet, while in Labrador where the snowfall is greater the height is 12 feet. A heavy snowfall, or drifted snow, occasionally enables the fox to reach sufficient elevation from which to leap upon the overhang and escape. The guard fence is built sufficiently high to overcome this difficulty. Some ranches are enclosed by a high board fence in order to prevent the drifting of snow in winter. Isolation pens and hospital pens are conveniently located in an adjacent lot. Some farms have a special lot for the pelting run.[10] Foxes are allowed to run in this enclosure some time before pelting so that the fur will be clean and in excellent condition for the harvest. The observation tower is an inclosure of considerable height with windows near the top, which conceals the observer and at the same time allows visual command of the entire fox farm. Observation towers on the down slope side of the ranch have the advantage of a better view of the pens (Fig. 4). Also, since the typical fox farm is located on the south slope, and since the observation tower is on the south side of the ranch, the observer does not have the disadvantage of facing the sun during the many hours spent in observing the condition of his foxes.

DEVELOPMENT OF THE INDUSTRY

Modern fur farming originated in Prince Edward Island where the conditions of the natural environment favored the early establishment and subsequent rapid development of the industry.

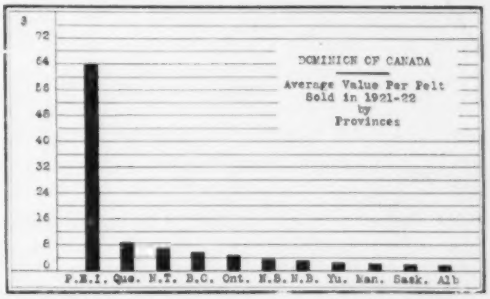

FIGURE 10.—Average value of pelts from all fur-bearing animals sold in Canada by provinces for the year 1922. The high rank of Prince Edward Island is due to specialization in fox farming.

ORIGIN OF FUR FARMING

It is natural to expect that the modern industry of fur farming would originate in Maritime Canada where traders and trappers have been active for nearly three centuries. The exploitation of wild fur-bearing animals advanced with the exploitation of timber resources. The destructive exploitation, *Raubwirtschaft*, of wild animals resulted in a continual decrease of the supply of raw furs. The short supply and the high prices resulting from a steady demand gave rise to a new animal-crop industry, the production of fur from domesticated foxes, which attempted to rehabilitate the fur trade. This movement orginated in Prince Edward Island where settlement and development of the country at the expense of the ruthless exploitation of fur-bearing animals and the virgin timber took place at an early date. Settlement and the fur trade could not exist together, because increased population annihilated the fur-bearing animals, or drove them over the ice floes to the isolated wilderness sections of the mainland where only the adventurous were attracted by the great profits of the fur business. On the other hand, it has been pointed out that the distribution of the modern industry of fur farming coincides with the population form of the landscape.

[10] J. A. Allen and J. E. Smith, "Fox Farming in Canada," Dept. of Agriculture, *Bulletin No. 12*, New Series, Ottawa, Ontario, Canada. p. 7.

Domestication of the wild fox was first successfully achieved by R. T. Oulton and Charles Dalton near Tignish, Prince Edward Island. These two farmers had hunted foxes together and had frequently bought and sold fox pelts of their neighbors. Oulton was once lucky enough to shoot a silver fox, the skin of which netted $138. They were impressed with the possibility of domesticating such valuable fur-bearing animals. They had followed the practice for several years of keeping foxes caught in warm weather alive until their fur was prime. After several years of experimentation in building fox-proof fences and in feeding and breeding foxes, they formed a partnership in the early 90's and built the first fox ranch in the world.[11] The Old Dalton Ranch now owned by W. K. Rogers contains more than 400 silver-black foxes. This was the forerunner of a thriving, and for Prince Edward Island, a revolutionizing industry.

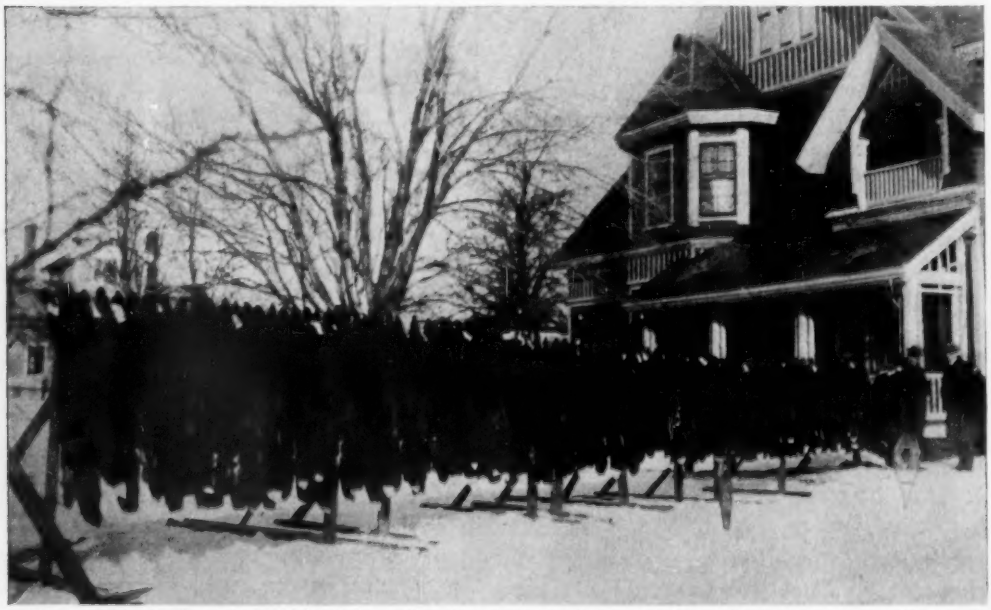

FIGURE 11.—Silver-tipped black fox pelts, the product of Prince Edward Island farms. (Courtesy of Canadian National Railway.)

TREND OF PRODUCTION

The gradual increase in the production of domesticated foxes has been continuous with the exception of a slight reverse during the World War. Although a few foxes have been kept in confinement in Prince Edward Island for a great number of years the great expansion of production did not really begin until 1910. Before this time fox raising was a secret pursuit in which only a few were allowed to participate. It soon became known generally that the few men engaged in the business were making handsome profits. Consequently, in the following year the demand for foundation stock became so great that all available foxes were sold for breeding purposes. During the boom of 1913, a price of $20,000 per pair was not unusual and exceptional specimens brought much more.[12] Speculative fox trading resulted in the establishment of 196 fur-farming com-

[11] Ned Dearborn, *op. cit.*, p. 4.

[12] J. A. Allen and J. E. Smith, *op. cit.*, p. 3.

panies. The number of domesticated foxes on the island in April, 1914, was reported to be about 1,600, and in the following December about 2,600, an increase of 60 per cent. A decline in production took place after speculative fox trading had ceased during the World War due largely to financial conditions. Speculative venture was changed into a legitimate business, and since 1919, the production has increased steadily to an annual output of 8,000 to 10,000 foxes or skins selling at reasonable prices on a steady market.

The introduction of scientific methods of farm practice, and research in feeding and disease control, have been potent elements in greater quantity and better quality production. The Canadian Silver Fox Breeders' Association has done much to promote a greater and better fur industry on the island. The Prince Edward Island Silver Fox Breeders' Association maintains an experiment station to demonstrate and teach the best scientific methods of farm practice. The association has taught the farmers how to make careful selection of stock for breeding purposes, and through fox registration and long experience with experimentation in selection has produced a superior strain of silver-black foxes on the island.

Through years of experience and with the service of the Experiment Station, the island fox farmer found that he must follow definite scientific methods of feeding in order to get greater quantity and better quality production. Foxes are scientifically fed according to the maintenance ration, so that deficiency diseases might be avoided.[13] The maintenance ration is the minimum amount of food required to maintain the body weight. The best results are obtained when the foxes are fed daily rations which are greater by 5 or 10 per cent of food value in calories than the maintenance ration, and are made up from such foods as fish, fox biscuit which is made from cereals and cod liver oil, eggs, milk, meat trimmings, offal, especially tripe, heart, liver, and lights; and cereals. Combinations of these foods satisfy the food value requirements of foxes under all conditions with the best-known results. Also these foods are quickly and cheaply obtained in the fox-farming belt along the shore of the island. Fish abound in all of the coastal waters. Fox biscuit, meat trimmings, and cod liver oil are produced at Charlottetown. The remaining foods, except rice, are obtained from the general farms which are rather evenly distributed over 87 per cent of the island surface.

Fox diseases are common and often decrease production remarkably, or seriously damage the fur. The presence of disease is costly among animals valued at $200 to $1,000 per head. Foxes are subject to most of the disorders of canines. The symptoms of some of these diseases are difficult to detect, because the fox does not betray any external manifestations in the presence of observers. This obstacle is overcome through the use of an observation tower, or lookout (Fig. 4). In this way the skilled observer can detect disease in its early stage and place the stricken animal in the isolation hospital for further observation and treatment. The Experiment Station carries on research on the control and treatment of disease, from which the findings are available for use by the farmer or the ranch veterinary. Obviously, the increase in the production of foxes has been due (1) to an increase in the number and size of farms, (2) to the better performance of farm practice, and (3) to the long experience in performance and methodic experimentation.

STATUS OF THE INDUSTRY

Prince Edward Island is the largest producer of domesticated foxes in the world. This fact is established by a measure of the industry in terms of the total value of animals, trade in animals and pelts, number of fur farms, and total number of animals owned by the fur farmers. In 1923, a total of 448 fox

[13] *Ibid.*, pp. 36–37.

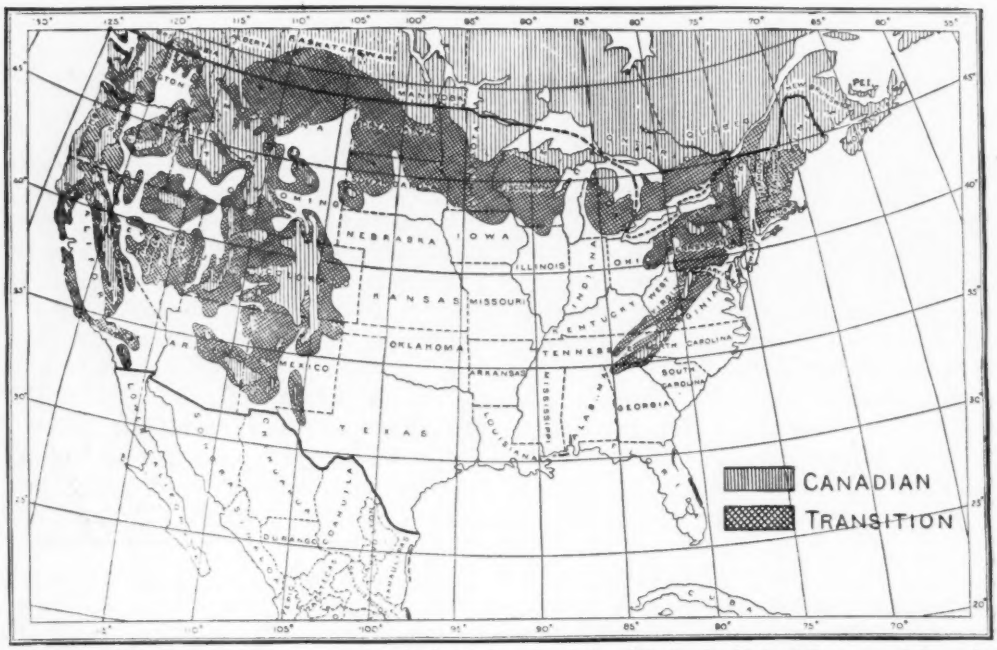

FIGURE 12.—Map of the life zone in which fox farming is feasible in the United States and Canada based on climatic conditions and natural habitat. In the Canadian Zone the climatic conditions are considered excellent. In parts of the Transition Zone the conditions are favorable, but in the unshaded portion, fox farming can be carried on only with great difficulty. (U. S. Dept. of Agriculture, Bulletin No. 301.)

farms contained 13,384 foxes valued at $2,689, 372. During the same year 8,658 animals and pelts were placed on the market, yielding a cash return of $1,195,562 to the fur farmers.[14] The Province of Ontario, the leading competitor in the fur industry (Fig. 9), had 201 farms with a total of 5,193 animals valued at $850,000. Figuring on a relative basis, the latter industry is equal to about 40 per cent of the former in volume, and only 32 per cent in value. The magnitude and superiority of the island industry is outstanding.

The fur farming of Prince Edward Island shows a high degree of specialization (Figs. 10, 13). In this subdivision of Maritime Canada high-grade foxes are raised almost exclusively. Of the number of foxes on all the farms in 1923, a total of 12,960 (96.8 per cent) were silver-black foxes, a strain with superior color and fineness of fur developed by man through long experience in the performance of raising foxes in this area where geographic conditions are very favorable to the industry. On the fox farms of Ontario, 47 per cent of the stock is of this high-grade strain, and even much of the Ontario stock developed by importing registered silver-black foxes from Prince Edward Island. This is true of most all fox-farming districts. In fact, foxes of Prince Edward Island registry can be found in all fox-farming districts of any importance in the world. Therefore, this island industry may well be regarded as the nucleus of a prosperous, middle-latitude, animal-crop industry.

[14] Dominion Bureau of Statistics, *op. cit.*, pp. 17–19.

FARM PRACTICES AS RELATED TO NATURAL CONDITIONS

The farm practice on the fox ranches of Prince Edward Island is closely related to the conditions of the natural environment. Climate, seacoast, land surface, drainage, soil, and vegetation are

the most important geographic factors involved in the farm practice.

PRODUCTION AS RELATED TO CLIMATE

A severe winter climate is essential for the production of good quality fur. The fox spends a good deal of time out of doors in the winter and the low temperatures which prevail in the Severe Winter Continental Climate of Prince Edward Island cause the fox to grow a heavy, prime coat of fur as a means of protection against the cold. The heavy fall of snow and the long duration improves the quality of the fur since the snow cover and the uniform frozen state of débris prevents the fur from becoming soiled or damaged. Alternate freezing and thawing is bad for fox fur because the fox often lays on the damp ground and some of the fur will become frozen fast to the earth and pulled out or broken off when the animal gets up. This is especially true of the tail and limbs where the heat of the body does not keep the ground from freezing. This condition of affairs does not often prevail in the Severe Winter Continental Climate. Reports of London, New York, and Montreal fur buyers show that the highest quality furs come from cool to cold, moderately humid regions. Then the humid part of the Severe Winter Continental Climatic Region is best suited for fox-fur culture so far as the climatic form is concerned. The leading producers attach great importance to the island climate when speaking of quality production. Prince Edward Island, with nearly 40 inches of rainfall, a mean annual temperature of 42 degrees, low winter temperatures, and abundance of snow, is an ideal climatic location for fox farming. The island is well within the limits of the Canadian Life Zone[15] as outlined by the Biological Survey on the basis of temperature, humidity, and natural habitat (Fig. 10).

The functions of climate pertaining to food supply, feeding, disease, and mortality rate are significant in the farm performance. Meat is one of the important foods in the fox diet, and, due to the rapid rate of deterioration when improperly handled, it is often a serious

FIGURE 13.—A typical silver-black fox in his Prince Edward Island environment. The foxes' natural environment is well reproduced with the aid of trees which are conveniently placed without sacrificing too much sunlight. (Courtesy of Canadian National Railway.)

menace to the good health of foxes. Cold storage facilities are used to overcome this difficulty. The Island Cold Storage Co., Ltd., handles the fox meat for Charlottetown and vicinity. Stale foods are often the cause of death among foxes. This danger is greatest in the warmer seasons when deteriorated food is apt to accumulate on the farm. The damage and loss of foxes from disease is considerably less in the Severe Winter Continental Climate where the winters are long and the summers short and rather cool. During the winter months climate provides a natural cold storage in which the food supply always remains fresh, and the parasitic contraction is reduced to a minimum.

Seasonal changes cause injury to foxes through dietary deficiencies when corrective measures are not applied. The foxes eat snow for their water supply to a considerable extent during the winter, and of course snow is devoid of mineral matter.[16] Meat and some other fox foods are deficient in mineral matter. The farmers of Prince Edward Island

[15] Ned Dearborn, *op. cit.*, p. 7

[16] J. A. Allen and J. E. Smith, *op. cit.*, p. 32.

use whole cow's milk, and a suitable fox biscuit which contains at least four ounces of cod liver oil, to counteract some of the dietary deficiencies. Foxes consume large quantities of milk in the winter time except during the mating season which extends from the middle of January to the middle of February. Foods in a frozen state are eaten by foxes without any ill effects on the digestive system.

The mortality rate of foxes has a close connection to seasonal changes. In 1923, there were 10,309 foxes born on the farms of Prince Edward Island, and out of this number, 1,684 animals (16 per cent) died from natural causes.[17] It is estimated that about 70 per cent of this number died during the warmer seasons. The mortality rate is lowest during the winter when the débris is frozen and the ground is covered with snow. The death rate among foxes is rather high, but it has been reduced immensely during the past two decades. The mortality rate has been lowered through scientific research in disease, and sanitary method, at the island Experiment Station.

PRODUCTION AS RELATED TO THE SEACOAST

Fox farms in Prince Edward Island have been drawn near the coast by the abundance of cheap sea food, by the presence of urban agglomerations with their facilities for communication with the mainland and overseas exporting points. The chief sea foods used on the fox farms are fresh haddock, smelts, and herring, as well as oil extracted from the liver of cod fish. These foods can be obtained at low cost by farms along the coast while the inland farms are at a disadvantage in this respect. Domesticated foxes need careful attention at all times by skilled caretakers who cannot be engaged in securing food supplies from long distances without injury to the farm performance and economy. There is a decided advantage in having a farm located near a point on the coast where cheap sea foods and transportation facilities are available.

THE FUNCTION OF LAND SURFACE, DRAINAGE, AND SOIL IN THE FARM PERFORMANCE

Land surface and drainage conditions have a close connection to fox farming. The alert fox farmer of Prince Edward Island seeks to locate his farm on a south facing slope. A farm placed on such a slope has evident advantages, because this slope, which receives the maximum amount of insolation, has excellent drainage and is freed of snow in the early spring leaving the ground dry before the pups come out of the dens. The mortality rate is very high among young foxes, and attention to these seemingly minute details is very important to the welfare of the young. In Prince Edward Island 70 per cent of the foxes which die a natural death are young foxes.[18] Farms located on south facing slopes seem to have the best results in rearing their young.

The nature of the soil is important in the fox-farming industry. Generally speaking, the soils of Prince Edward Island are for the most part rather loose, fine to medium in texture, and friable in the surface horizon, but compact, coarse to medium in texture and less friable in the subsurface horizons. A loose soil with a medium texture in the surface horizon is best suited to fox farming. A clay surface horizon is to be avoided, but a compact soil with clay or stones in the subsurface horizons is an advantage as foxes will not dig ground hard enough to require a pick to break it up, while with friable subsurface layers the fox is free to burrow.

The physical aspects of the soil must be favorable to the support of underground runways. The foxes are able to burrow one or two feet on most island ranches, but rarely is one lost by smothering due to the soil giving way. Compact subsurface horizons give the proper

[17] Dominion Bureau of Statistics, *op. cit.*, p. 11.

[18] *Ibid.*, p. 16.

support. In areas with loose subsurface horizons many foxes have been lost by smothering in the runways when the soil gave way. Pure sand underneath the surface of a fox ranch is dangerous. These lower soil layers must have some binding material like silt, clay, stone slabs, or roots of trees to render the soil capable of supporting underground runways.

The function of the soil form as related to farm practice deserves rather careful consideration. In nature the fox was free to roam about over a wide territory, but in captivity many are crowded into a small space where the surface soil becomes fouled from excretions and secretions, which condition furnishes a nidus for parasitic infections. Therefore, a contaminated soil under foot is a source of disease and the object of great danger to animal health. It has been pointed out in another connection that the mortality rate decreases during the winter months when the contaminated soil is covered with snow. The farmer finds it necessary thoroughly and frequently to disinfect the soil during the months when the ground is not frozen or covered with snow. The loose sandy loam surface soil is easily agitated, disinfected, or replaced with fresh earth. A very modern way of disinfecting the fox premises is through the use of a paraffin gas-oil blow torch.[19] The intense heat of the flame will destroy all eggs and parasites wherever it is applied. The soil is agitated in the process to insure perfect disinfection.

VEGETATION AND ANIMAL LIFE

Vegetation and animal life are related to the fox-farming industry. The thoughtful island farmer locates his ranch among a growth of young trees thick enough to shade part of the ground.[20] Deciduous trees are preferable to conifers because they allow the sun to make the yards more comfortable in winter, to melt the snow and dry the ground earlier in the spring. Old trees are not allowed to remain on the farms, because they are apt to blow over in stormy weather, break down the fence, and provide the foxes with an avenue of escape (Fig. 11).

Animal life takes a notable part in the farm performance. On many farms healthy cats are kept to act as foster mothers to orphan pups for about three weeks after which they are able to care for themselves. On a few farms fox hounds are trained to overtake and hold without injury foxes that have escaped, and on some occasions bloodhounds have been employed to track thieves. Horses, cows, and smaller animals such as calves and rabbits furnish an important part of the food supply.

RELATION TO OTHER INDUSTRIES ON PRINCE EDWARD ISLAND

Other industries play an important part in the success of fox farming. This fur industry is closely associated to fishing, general farming, stock raising, dairying, poultry raising, and other allied agricultural industries. It has been pointed out that all of the foods, except rice, are produced locally on the island. A large part of the fox diet is offal, which would otherwise be partly wasted. The island is the chief livestock and poultry center of Maritime Canada. Large numbers of these animals are slaughtered at home, thus furnishing a large supply of offal and meat trimmings which are available for fox food. Eggs, milk, and cereals are produced in large quantities. Fox biscuits are manufactured from island oil, meat, and cereals at Charlottetown. Fishing is one of the major occupations of the people along the shores, and a fresh supply of fish is always obtainable at little cost from the numerous rivers, the bays, and the Gulf of St. Lawrence. It is not difficult to see how fox farming is a favorable adjunct to the agricultural economy (Fig. 4). Many farmers of the island consider the fur industry to be on a par in their economic organization

[19] A. J. Allen and J. E. Smith, *op. cit.*, p. 14.
[20] *Ibid.*, pp. 3–4.

with the dairy, poultry, and live-stock industries.

TRADE IN ANIMALS AND PELTS

Prince Edward Island furs bring top-notch prices in the leading fur markets of the world. There is an equally large demand for live foxes for breeding purposes.

SIGNIFICANCE OF COMMUNICATION TO TRADE

The great world markets for furs are located in large urban population agglomerations. Wholesale dealers in London, New York, and Montreal purchase practically all of the Prince Edward Island furs. These markets are located long distances from the centers of production, but distance is of little concern in the marketing cost of a valuable commodity of relatively small bulk. A peripheral or isolated location has little significance in the marketing of high-grade furs like the silver-black fox. Transportation is an important element in the marketing of low-grade furs. Consequently, we find isolated and peripheral areas specializing in high-grade stock. The wholesale fur dealers secure many silver-black fox skins of high quality from the farms about Whitehorse, Carmacks, and Dawson, Yukon Territory, and the adjacent districts of east central Alaska.[21] This is a center of mining where supplies are available. A valuable cargo of furs can be sledged long distances in this area to points of shipment with profit. It is the source of supplies that limits fur farming in these remote districts. For instance, the Aleutian Islands have a favorable climate for fox farming, but due to the sparce population, the general unproductiveness, the inability to import the necessary supplies at a reasonable cost, and the inability to produce food and other supplies locally, production is increasing less rapidly. On the other hand, it has been emphatically stated that the industry in Prince Edward Island occupies a position where the geographic conditions are favorable to fox farming.

[21] Ned Dearborn, *op. cit.*, p. 6.

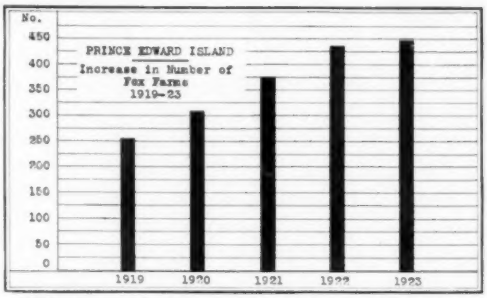

FIGURE 14.—Increase in the number of fox farms in Prince Edward Island during the past five years.

WORLD TRADE

A study of the island fur trade sets forth some very interesting facts. In 1923, a trade in foxes and fox skins valued at more than a million dollars was carried on between wholesale dealers and the island producers (Fig. 11). During the year 4,059 foxes (46.8 per cent) were sold for breeding purposes. This statement suggests that (1) the demand for Prince Edward Island registered foxes is large, (2) the industry is still greatly expanding, and (3) the fox farmers receive larger returns for their best quality live stock than could be obtained through the sale of their pelts because the marketing cost is much greater for the live animals. A total of 4,599 skins were marketed during the same year.[22] Reports on the fur trade of the island show that 249 fox producers (65 per cent) sold their fox pelts at auction sales in London, New York, and Montreal (largely London), while 67 sold direct to wholesale dealers in these centers, 56 sold through agents, and 18 sold by direct correspondence. The yearly average price for pelts sold from fox farms was $104, and for all animals sold to private customers about $200. The average value per pelt[23] for all furs sold from the island in 1922 was $64.

[22] Dominion Bureau of Statistics, *op. cit.*, p. 11.

[23] Dominion Bureau of Statistics, *The Canadian Year Book*, 1923, p. 344, Table 1.

Quebec held second place with a little more than $8 per pelt (Fig. 10). The highest average price of pelts sold from the fox farms in 1923 was $328 per pelt, and $700 for choice animals. Low-grade pelts resulting from disease or carelessness in the farm performance lowered the average price of pelts. Exceptional animals and pelts often bring fancy prices. The inflated prices just before the World War, when foxes brought as high as $35,000 per pair, no longer exist, but nevertheless the fox farming is still a very profitable business under optimum geographic conditions and scientific management.

SUMMARY

We have seen how the fur industry has shifted from the fanciful pursuit of the wild fox, or destructive exploitation, to the production of fox fur on a crop basis from domesticated animals. This modern industry has done much to relieve the industrial stagnation which has been evident in Prince Edward Island since the passing of a prosperous lumber and shipbuilding industry. Yet just how far has the industry advanced, and what are the future possibilities of expansion? Surely we are bound to see a greater expansion of fox farming in favorable areas with advances in the stage of development, with increased population, with decrease in natural game areas, with continued destruction of the natural habitat of wild animals, and with the steady to increasing demand for fur to be used in wearing apparel. There is no need for expansion into lower latitudes where acclimation is very difficult, since there is still room for development in the Northern Middle-latitude areas where the geographic forms of climate, sea and coast, soil, land surface, drainage, vegetation and animal life, distribution of population, communication, and production of supplies together with the economic factors of land, labor, capital, and markets will function so as to meet successfully the competition of the older producing areas; and will guarantee a legitimate profit on the investment. Through acclimation foxes can be raised over a vast expanse of territory, and the industry is rapidly expanding over favorable sections of North America and Europe. This expansion may be expected to continue for many years.

BOOK REVIEWS

DEPARTMENT OF COMMERCE

Bureau of Foreign and Domestic Commerce

Foreign Commerce and Navigation of the United States, Calendar Year 1925, Vol. 1. This volume presents in detailed form the foreign commerce of the United States. Summary tables are given for the exports and imports of domestic merchandise for 1923–1925, and domestic exports and imports by countries and groups for 1925. In addition there are six tables showing the movement of commodities into this country and out of it by countries and customs districts. The price is $1.50.

Statistical Abstract of the United States, 1925. There is no more important or comprehensive publication assembling significant statistical data regarding the United States than the Statistical Abstract. The 1925 edition has just appeared. Material for this book is assembled from all the government departments and from many private business and financial houses. It briefly summarizes statistical data contained in the United States census, commercial information in foreign commerce and navigation of the United States, valuable railroad data from the Interstate Commerce Commission, postal information from the reports of the Postmaster General, and much information assembled by the Bureau of Foreign and Domestic Commerce. This brief list simply suggests the scope of the volume which is a veritable dictionary of pertinent and significant statistical economic facts relating to the United States and foreign countries. Price, $1.00.

Commercial and Industrial Organizations of the United States. Domestic Commerce Series No. 5. Price, 60 cents. This presents an extensive classified list of commercial organizations throughout the United States, something which will be of considerable value to economic geographers in doing field work in a region, or in coming in contact with the important manufacturers in any given area.

Railways of South America: Part I. Argentina, by George S. Brady. Trade Promotion Series No. 32. Price, 50 cents. Argentina ranks first among the Latin American countries in railway mileage. The largest and most important railroads of the republic are British owned and represent an investment of more than one billion dollars. State owned lines, however, are increasing in importance, and government and private capital in Argentina is developing railroads which have been a prime factor in the progress of the Argentine Republic. In the history of the railroads there is the history of the commercial life of the country.

Mr. Brady was American Trade Commissioner at Buenos Aires for several years, closely in touch with the railway as well as all other economic activities in that country. In this bulletin he has discussed the history of the Argentine railroads, has described Argentina with its various types of industry, and then has taken up individually the different railroad lines of the republic. Maps and other illustrations in addition to well chosen statistics add value to the book.

Siberia, Its Resources and Possibilities, by Boris Baievsky. Trade Promotion Series No. 36. This very brief summary of the resources of Siberia by the Russian expert of the Bureau of Foreign and Domestic Commerce comprises a contribution to geographic information. It covers a field hitherto little touched in English, and discusses at some length the physical resources of the country together with its present and potential economic development.

Trade Information Bulletins. The Trade Information Bulletins published by the Bureau of Foreign and Domestic Commerce within the last three months cover a wide range of subjects and many different countries.

Ocean Freight Rates in United States Foreign Trade, by A. E. Sanderson. This handles a problem on which it is difficult to find summary information, and is one of interest to American exporters and to students of commerce. The amount of our foreign trade especially in highly competitive lines depends in no small measure on the cost of ocean transportation. This bulletin discusses both ocean freight rates and the factors which influence them, together with the services of tramps and liners, as well as liner conferences.

The Australian Lumber Market, by Julian B. Foster, Assistant Trade Commissioner at Melbourne, presents statistics of lumber consumption for Australia and analyzes the market relations for this product.

Costs of Transportation and Handling of Argentine Wheat, by Harold R. Brown, American Vice Consul, and Brice M. Mace, Jr., American Trade Commissioner, at Buenos Aires. Conditions in Argentina relating to the shipment of wheat are in contrast with those in the United States. Nearly all of the wheat country is comparatively close to ocean transportation. This bulletin discusses the problems of transportation from the country to the railroad station and to the seaboard, port charges, methods of packing, insurance and loading facilities.

Markets of Central Chile, by Rollo S. Smith. This presents a brief but interesting picture of the great valley of Chile which contains most of the people of that country. It is the principal area susceptible to agricultural and industrial development, and is consequently the principal sales market for foreign goods.

Transportation and Communication in the United States, 1925. A reprint from the 1925 Commerce Yearbook. This presents briefly and concisely the salient points relating to railway and water transportation within the United

States in 1925. While economy and efficiency marked the operation of the railroads in 1924, the year 1925 witnessed new records. Traffic, measured in ton miles, was even greater than in the peak year 1923, and 6.6 per cent heavier than in 1924. As compared with 1924 the operating revenues increased 3.3 per cent; operating expenses, however, were greater by only 0.6 per cent, and net railway operating income therefore gained about 15 per cent, freight and passenger rates remained practically the same. Traffic was moved not only without delay or interruption but almost with no car shortages and high car surplusses, but also with greater rapidity and efficiency. The figures for motor transportation show some interesting comparisons with those of the world total, and indicate that more than four-fifths of the automobiles in operation in the world are in the United States. In the section on water transportation are found some interesting facts relating to inland waterways and to ocean shipping.

Below is a list of some of the other bulletins published by the bureau:

United States Trade with Latin America in 1925. Part II—Southern Latin America, by J. R. McKey, Assistant Chief, Latin American Division, and H. S. Giusta, Assistant Special Agent.

Switzerland, Resources, Industries and Trade, by Chester Lloyd Jones, American Commercial Attaché, Paris.

United States Trade with the British Empire in Hides, Skins and Leather, by J. Schnitzer, Hide and Leather Division.

Furniture Markets of the Far East, by Kenneth M. Hill, Specialties Division. Compiled from reports of Consular Officers of the Department of State and oversea representatives of the Department of Commerce.

Investments in Latin America. III. Chile, by Frederic M. Halsey, Special Agent, and G. Butler Sherwell, Finance and Investment Division.

Shipment of Samples and Advertising Matter to Asia, Africa and Insular Possessions, by Roberta P. Wakefield, Division of Foreign Tariffs.

Latin American Monetary and Exchange Conditions, by C. A. McQueen, Special Agent.

Automotive Equipment and Construction Preferences in Foreign Countries, compiled by H. C. Schuette, Automotive Division. Based on reports of consular officers of the Department of State and Representatives of the Department of Commerce.

World Radio Markets in 1926, by Lawrence D. Batson, Electrical Equipment Division, compiled from reports of Consular Officers of the Department of State and oversea representatives of the Department of Commerce.

Export Trade in Rubber Footwear, 1925, by E. G. Holt, Chief, Rubber Division.

Foreign Trade of the United States in the Calendar Year 1925 According to International Statistical Classification. Prepared in the Division of Statistics.

The price of all of these Trade Information Bulletins is 10 cents each.

The Monthly Summary of Foreign Commerce of the United States, June, 1926: Parts I and II. These contain statistics of exports of domestic merchandise, and imports for June, 1925 and 1926, and for the twelve months ended June, 1925 and 1926. Single copies Part I, 10 cents; Part II, 5 cents. Annual subscription, $1.25.

BUREAU OF THE CENSUS

With the rapid development of manufactures and agriculture it has been apparent that the ten-year intervals for taking the census did not provide the business world with necessary information. Consequently the Census of Manufactures now appears biennially and that of Agriculture at five-year intervals. The biennial Census of Manufactures for 1923 is now available. Price is $1.75. The Agricultural Census has been issued in preliminary mimeographed sheets for the states and counties and may be obtained from the Bureau of the Census. The Bureau of the Census also has published complete summaries of the Census of Agriculture for 1925 in bulletin form for a number of states. Others will appear in the near future. The price of these bulletins is 10 cents each.

Cotton Production in the United States, Crop of 1925. This report consists of tables showing cotton produced and ginned by states and counties. Price, 10 cents.

Stocks of Leaf Tobacco, and the American Production, Imports, Exports and Consumption of Tobacco and Tobacco Products, 1925. Price, 10 cents.

BUREAU OF MINES

Mineral Resources of the United States in 1925. Preliminary Summary. Price, 20 cents. A valuable current statistical record giving production of minerals and metals in the United States and foreign countries, together with some export and import figures for these commodities. Separates from Mineral Resources of the United States in 1925 have appeared as follows:

Fluospar and Cryolite in 1925. Price, 5 cents.

Gold, Silver, Copper, Lead, and Zinc in Nevada in 1924. Price, 5 cents.

Red Iron Ores and Ferruginous Sandstones of the Clinton Formation in the Birmingham District, Alabama, by W. R. Crane. Price, 10 cents.

Descriptive List of Motion-Picture Films and Plan of Distribution. This publication gives brief descriptions of the motion picture films made and loaned by the Bureau of Mines.

Coal in 1923. A bulletin appearing as a publication of the Geological Survey but distributed by the Bureau of Mines, since the Mineral Resources of the United States is now issued by the Bureau of Mines.

Cement in 1924. An account of the growth of the Portland cement industry.

BUREAU OF FISHERIES

Fisheries of Siberia, by Boris Baievsky, Russian export of the Bureau of Foreign and Domestic Commerce. The fisheries of Siberia are little known but extremely valuable. This bulletin presents the results of careful research into the problem, is illustrated by maps, and contains pertinent statistical material.

UNITED STATES COAST AND GEODETIC SURVEY

Geographers may be interested in the very fine four-sheet map of the Philippines issued by the Coast and Geodetic Survey, on a scale of 1:1,000,000. It is in colors and shows the provinces in the various islands, together with important cities and rivers. This may be obtained from the Coast and Geodetic Survey. The Coast and Geodetic Survey also issues books known as "pilots" which contain graphic and detailed descriptions of coastal waters in United States territory.

Geographers interested in map making will be glad to know of the *Elements of Map Production*, by Charles H. Deetz and Oscar S. Adams, Special Publication No. 68. Price, 50 cents.

All government publications mentioned above may be obtained from the Superintendent of Documents, Washington, D. C., unless otherwise stated.

RUTTER, OWEN. *The New Baltic States and Their Future.* 274 pp. Illustrations and map. Houghton Mifflin Company, Boston, 1926.

"The English-speaking people have a superficial knowledge of the countries of Europe, especially of Eastern Europe." Major Owen Rutter has assumed the self-imposed task of acquainting the world, and particularly the English-speaking world, with the three new Baltic republics. In his "New Baltic States" he has rendered valuable service in laying the foundations for future understanding by presenting the past and interpreting present conditions in these countries.

At the close of the Great War three Baltic nations emerged from the confusion and devastation of Europe's "shatter belt." The victory of the Allies enabled Lithuania, Latvia, and Estonia to proclaim their independence and now, less than a decade since the Armistice, they are prospering, their governments are stable, the people, once landless, are farming their own land and their budgets balance. The struggle for political freedom has been a long one; for eight centuries foreign powers ground the peasant beneath an iron heel. As buffer provinces their farmlands provided during the recent war the battle ground across which the armies of Russia and Germany advanced and retreated. It is remarkable that in spite of centuries of political subjection and the suppression of culture, their individuality, language, and national consciousness should have been preserved. Their intermediate location, athwart Russia's exit to the western ocean, insures a strategic commercial importance disproportionate to their area and resources. For, while Leningrad (St. Petersburg) is ice-bound during the height of winter, several ports of these new states (Riga, Memel, Libau and Windau) are either ice-free or can be kept open with little difficulty. Through these ports trade is flowing today in increasing volume, and as economic conditions in Russia assume normalcy, the Baltic States may be expected to enjoy an added amount of prosperity.

Major Rutter presents the historical and geographic setting of each state in a direct and interesting manner. Even the casual reader will appreciate the significance to Lithuania of the lost Vilna, and of other problems grave enough to disturb the peace of Europe. However, the author makes clear his impelling motive to acquaint the foreign capitalist, merchant, and trader with the commercial possibilities which these states offer. Already they have justified the confidence reposed in them by the Great Powers; within a few years, provided the present rate of development continues, they may rank with the minor nations of Europe.

Lithuania, Latvia, and Estonia comprise a part of the Northern European Plain. Practically one-half the area of each State is arable. As mineral wealth is almost absent the main source of future wealth must come from agriculture. Before the war the majority of the farming population (80% in Lithuania) was landless; since the Agrarian Reform agricultural land has been distributed to the landless. Up to 1924, 22,000 new farms had been created in Lithuania. Without question the reform saved these infant nations from Bolshevism and has created a happy and contented agricultural population. Flax formerly held a high place among the exports, but today dairy products are assuming importance. Coöperative dairy organizations are being established, patterned on the Danish methods; it is expected that the Baltic States may soon enter the European markets as active competitors of Denmark.

With the exception of oil shale in Estonia, the Baltic States lack minerals. In the absence of coal, peat which occurs in limited quantities is utilized. Much of the virgin forest remains, mainly pine, fir, birch, oak, and alder. Before the war, Riga was the greatest timber port of the world as quantities of Russian lumber found its natural outlet here. The destruction of machinery during the war has handicapped the industries which depend on wood—paper mills, cellulose and match factories, and wood distilleries; the resumption of manufacturing will increase all types of wood exports.

The control of several Baltic ports is the out-

standing advantage of these states. Klaipeda (Memel) in Lithuania Minor, administered by Lithuania, is the outlet of the productive Niemen Valley. The harbor is a good one, open throughout the year. Latvia's ports, Liepaja (Libau) and Ventspils (Windau) are almost entirely ice-free, while Riga, "the window of the Baltic" and former outlet for Russian exports, is closed only a few weeks in winter. Tallinn (Reval) in Estonia may compete with Riga for the Russian transit trade, as excellent rail connections exist between Russian and Western Europe *via* this port. It has been suggested that as Russia is the natural market of the Baltic States and on the other hand, these states control the ice-free ports of the head of the Baltic, it might be to the advantage of these countries to enter the Russian Customs Tariff. Major Rutter admits the possibility of these states becoming autonomous units under a new Russia, but it is doubtful if the majority would tolerate the idea of Russian sovereignty. As signatories of the Barcelona Convention, the Baltic States are pledged to grant all friendly countries free transit through their territories in time of peace and at present they are trying to facilitate trade with Russia.

Realizing that in unity there is strength, Latvia, Lithuania, Estonia, Finland, and Poland have formed a permanent Inter-Baltic Committee with headquarters at Riga. The adoption of common tariff and customs laws by the three Baltic States will insure a stable economic status.

As champion of the three Baltic States, the author asserts that British and American firms are not making the most of their opportunities—this no doubt is due to ignorance of local conditions and conservatism. Admittedly the Baltic markets mean more to Great Britain than to the United States, though the volume of trade between the Baltic and America is increasing yearly. The general feeling among many who have not studied the question is that Russia may absorb these new republics as, once reorganized, she will wish to regain her lost ports. The future of the Baltic States is undoubtedly bound up with the future of Russia. But each state has demonstrated its ability to take care of itself. Also, the Agrarian Reform has insured a contented population who will be unlikely to affiliate themselves with the Communists. Moreover, Soviet Russia could not attack the Baltic States without arousing the enmity of the remainder of Europe.

Major Rutter's account of the Baltic States will appeal to a wide circle of readers. Daily life, customs, religions, folklore, proverbs, and superstitions of the people are vividly described. An entire chapter is devoted to education. Illustrations, one large map, classified bibliography, and an exhaustive index complete a most comprehensive and sympathetic review of conditions in the new Baltic States.

RUTH E. BAUGH.

DALY, REGINALD ALDWORTH. *Our Mobile Earth.* xxii and 342 pp.; illustrations, maps, diagrams, bibliography, and index. Charles Scribner's Sons, New York, 1926. $5.00. 9 x 6 inches.

Our Mobile Earth is one of those stimulating books that impel men's minds to deeper and better thought, that urge them into new and broader fields of research. It is a gateway to Truth, and so to that larger Freedom that all of us are seeking. Whether or not everybody who reads Professor Daly's book agrees with his conclusions is a secondary matter; nobody can help being stirred by his dramatic account of the great forces that are shaping this earth of ours, and have shaped it for eons past.

The book opens with two comprehensive chapters on the great earthquakes of history and their nature, one of the best summaries of this large subject in the language. He follows this with two masterful chapters on the earth's interior, and volcanic action, and then three keen chapters on changes of level, mountain ranges, and origin of mountain ranges. It is in these three chapters that Professor Daly presents his gripping theories of mountain-making, invoking the drift, or migration, of continents as the agency by which the earth's crust has been piled up in the great crescentic mountain ridges of Eurasia, and the coastal garland-chains of America. It is a thrilling story that he tells, particularly in chapter seven—"The Origin of Mountain Ranges"—and it is so convincingly supported by well chosen evidence that he seems to prove his points conclusively. Following E. Suess, F. B. Taylor, and A. Wegener in their daring hypotheses of the migrations of the continents over distances of hundreds, even thousands, of miles, he goes courageously several steps farther and points the way still farther on. His closing chapter, "Evolution of the Face of the Earth," is climactically stimulating. In it he summarizes and correlates his theories and his evidence, in such a way as to leave little room for doubt or question.

This book is a splendid achievement, a work that would crown worthily the rich life that Professor Daly has led as scientist, scholar, capable leader of research, if he were to lay down his pen now to rest from the arduous work that he has done. But to him work is play, and undoubtedly other stimulating books are still to come!

Best of all this book is written so clearly and so directly that the "average reader" will have no trouble reading and understanding it, and will be charmed by the simplicity of the author's diction even as he is thrilled by the breadth of the author's vision.

To the economic geographer it constitutes one of those basic references, to which he must ever turn, like the fundamental works of Chamberlain,

and Ward, and Semple. It will occupy a proud place on his book shelf.

W. ELMER EKBLAW.

THOMPSON, WALLACE. *Rainbow Countries of Central America.* xi and 284 pp., with maps and illustrations. E. P. Dutton and Company, New York, 1926. $5.00.

This book deserves rank with the most carefully prepared general treatises on Central America that have appeared in recent years. It might well be classified as illustrating some aspects of the philosophy of Human Economic Geography, if a term so complex may be permitted entree into the realms of the intellectually élite.

There are sixteen chapters in the book. The first is a general introduction giving something of the broad features of the physical geography of Central America, the historic background, including the Mayas, the Conquistadores, and even that of the Pirates who plundered along the Spanish Main. Having thus presented some of the glamour of the region from the standpoints of nature and of history, the author gives some very practical hints to prospective travelers as to proper preparation for the journey, then carries them across the Gulf of Mexico and the Caribbean Sea to the Canal Zone. Little time is spent there because Panama is not considered as part of Central America, but the reader is carefully prepared for the journeys through the republics to the north.

The next six chapters are devoted to the five republics, Guatemala being honored with two, while each of the other countries are treated in single chapters. Were the book to be widely read in Central America this favoritism might be considered indiscreet, for can anyone imagine, *e.g.*, a sensitive-souled Costa Rican content with less chapters than are devoted to Guatemala?

The last 120 pages are divided into nine chapters wherein are summarized the general features of social and economic interest in Central America. Some of the headings suggest the scope and content: "Pageant of Agriculture," "Highways to Progress," "Trade and Friendships," "The Human Background," "The Ways of Thought," "Politics and Revolutions."

For each country the leading resources and industries are given brief and pointed treatment. Statements are supported by statistical data giving recent progress, but there is no attempt to make this feature exhaustive, evidently on the basis that the reader is only interested in having brought up to date the larger phases of industrial development. This method brings contrasts into sharp relief, a commendable feature although the picture thus created visits to the various countries tend to render significant.

The book has, to the reviewer, two features of marked excellence when compared with several others which have appeared from time to time. In the first place the author continually points out relationships; he not only describes an areal or industrial situation, but he indicates at least to some extent why it is so and points out the consequences to which it leads. This study of relationships, both causal and consequential, gives a slant to the discussion which to most geographers is highly welcome. In the second place, the discussion is frank, evidently representing a sincere attempt to give a fair picture of present conditions. It is not monotonously laudatory. Some conditions are fearlessly criticized but there is nowhere any evidence of lack of sympathy, or failure to appreciate problems from the point of view of the Central Americans themselves.

NELS A. BENGTSON.

CHIROL, SIR VALENTINE. *India.* vii and 352 pp.; index. Charles Scribner's Sons, New York, 1926. 8¾ x 5¾ inches. $3.00.

HARDY, G. GATHORNE. *Norway.* 324 pp.; index. Charles Scribner's Sons, New York, 1925. 8¾ x 5¾ inches. $3.00.

MAKEEV, NICHOLAS and O'HARA, VALENTINE. *Russia.* xi and 346 pp.; appendices, index. Charles Scribner's Sons, New York, 1925. 8¾ x 5¾ inches. $3.00.

TOYNBEE, ARNOLD J. and KIRKWOOD, KENNETH P. *Turkey.* xv and 329 pp.; appendix, index, maps. Charles Scribner's Sons, New York, 1927. 8¾ x 5¾ inches. $3.00.

The tremendous task involved in the administration of a population of 320,000,000 individuals, most of whom are economically immobile, speaking 222 distinct languages and innumerable dialects, forms the basis for the very excellent *India.* With a decisive brilliancy of exposition, Sir Valentine Chirol, to whom the student of modern India needs no introduction, presents a most definite picture of the India of today. Clearly and firmly the author delineates the growth and the reactions of the tremendous forces, spiritual, economic, and political, ancient and modern, which have determined the crystallization of contemporary India.

Although the volume has been written from a distinctly British viewpoint, a warmly sympathetic understanding of the silent masses of India and their problems permeates its pages. In addition, there is set forth the beneficial work of Great Britain in providing 38,000 miles of railways, in developing 20,000,000 acres of land by the completion of huge irrigation projects, and in minimizing the ravages of famine. Under present conditions the famines of India are inevitable. Although the land appears to be heavily burdened with population, the agricultural possibilities have scarcely been scratched. Too, there exists the queer trick of the collective Hindu's *karma*, or fate, which has made of that most useful of providers, the cow, a sacred object.

Admirably well indexed, the book considers in turn those factors which have directed the tide of

Indian development. From a concise, lucid introduction to the geographical and ethnographical features of the land, the survey leads to a comprehensive consideration of the great complex of India. By reason of the lack of definite racial, social, or religious affinity with the rest of India, Burma is not included in the discussion.

The difficulties of dealing with a Hindu people, forming the larger portion of the population, whose religion has been the negation of everything that constitutes a nation, are evident. The insurmountable hindrances of absolute inflexibility of caste, "untouchability," and the fatalism of the individual *karma*, basic factors in the development of the Indian nation, contribute. Well-organized chapters portray the work of spiritual, intellectual, and social forces. The fundamental influences of Hinduism and the effects of the former Mohammedan domination receive their proper emphasis. Similarly, the author traces the inflow of Western Influence and the tangle created by Western Education in India with unhesitating definition.

The theme propounds the principles of British rule, the great trusteeship of Burke, from the incipience of the British East India Company to the present. The discussions of the great waves of reaction, non-coöperation, swaraj, all, are salient instances of frank handling of subject.

The wholly fine treatment of the economic development of India, abnormally quickened by the extreme industrialization demanded by the Great War, the consequent depression, and the effects of World forces, especially Bolshevism, is intensely pertinent.

For a keen, thorough, authoritative presentation of the intellectual, economic, and political forces which have shaped the India of today, Sir Valentine Chirol's *India* is of utmost value.

Pulsating with a penetrating appreciation of an attractive land, *Norway*, by G. Gathorne Hardy, is a worthy companion to *India*. The fjorded land of the vikings is a perennial source of intriguing interest. Long hindered by nature and man, the security of future Norwegian progress is guaranteed. The long awaited prosperity, the natural due of the land, has begun. The lack of coal had been a vital factor in the lack of early industrial development. With the utilization of hydro-electric power, a transition period has been ushered in; and the rugged surface has vindicated itself.

In an introduction which maintains the contention that comparisons are odious and proceeds to draw several, for the invidiousness of which the author apologizes, he circumspectly distinguishes the Scandinavian countries as three entities. Denmark looks to Germany, Sweden to the Baltic, and Norway to the Atlantic, and to Great Britain. Sweeping forward from an auspicious first chapter, the enthusiasm of *Norway* enriches the reader's ideas of the land.

Often in direct contrast to the type of discussion expected of the Norway of today, the intricate tracing of the development of Norwegian nationality leads to many interesting considerations. The national spirit of Norway, formulated by the aristocratic vikings, has never been completely submerged. Its recrudescence was first manifest in the interval between Danish domination and the Swedish Union, both of which proved so unpalatable to the taste of an independence-loving people. With the dissolution of the Swedish Union, the spirit of nationality again flared forth.

The text launches into a seemingly unjustified and irrelevant treatment of the literature of Norway. But as is often the case, especially true of the northern country, only through literature may a complete revelation of national character be obtained. Two periods of Norwegian literature, an old and a modern, with a fruitless interval, bear eloquent testimony to the existence of a period of dormant national spirit.

As one continues, the geographic factors involved in every phase of Norwegian development create an indelible impression. They present themselves from the environment, which produced so intrinsic a national spirit, to the almost laughable conflict existent between *riksmaal* and *landsmaal*, result of Danish infiltrations. In fact, "Highly educated, and indeed literary Norwegians, constantly confess that they have no clear ideas as to how to spell."

On the basis of the first chapter and the last four alone, the volume deserves a place in the library of every geographer. The Norwegians first brought themselves before the eyes of the world as a maritime race. Nevertheless, "Farming in one way or another not only occupies a larger proportion of the population than any other industry, but actually produces a larger aggregate income." Further, in the words of the historian, O. A. Johnsen, "There is actually only one class in the country which is Norse in the full signification of the word, and that is the class of the farmers." The literature and political fortunes of the land may change, but the *bonde* remains the same. Because of early differences with the *Hansa*, there exists in Norway a fear of foreign capital. However, with the disappearance of such unfounded (so the author believes) fears, "Norway starts with all the slowly won experience," of other industrial countries, "at her disposal." The book closes with an interestingly visionary declaration of the possibility of a Norway in the rôle of impartial arbitrator, as a result of geographic isolation from the centers of political storms.

Avoiding the polemic treatment of Russian affairs, so frequently encountered in writings of recent years, the *Russia* of Nicholas Makeev and Valentine O'Hara is truly masterful. From the brilliant introduction to the matchless conclusions drawn by the two men who "perhaps know too much about present Russia," there is not a soli-

tary lapse of sustained excellence. The consummate comprehension displayed derives its significance from the careers of the co-authors. M. Makeev suffered imprisonment by the Tsarist Government, Mr. O'Hara by the Bolshevik Government. The former has been president of the board of the All-Russian Union of Zemstvos, the latter a member of the Anglo-Russian Committee in Petrograd.

The value of the volume is enhanced by two excellent appendices and an index. Appendix I is a summary of the more important data and dates of Russian history to the end of the nineteenth century. Appendix II is a most useful bibliography of references, concerning Russia in general, industry and trade, agriculture and the land problem, coöperation, foreign policy, the Revolution, and Soviet Russia—Bolshevism.

The interpretations throughout are economic and geographic in nature, convincing one of the apparent truth of Alexander Herzen's statement, "The past of the Russian people is dark. The present is terrible. But they have a right to the future."

Employing a decidedly relevant topical outline, the authors fashion *Russia* from earliest sources to the immediate present. The analyses of the contributions of Peter the Great, Catherine II, and the Church are indeed significant. From the inculcation of Western Culture, *Russia* progresses to the Rise of Democracy and the work of the Zemstvos, to the Downfall of the aristocracy as a result of the Revolution. It transports the reader to the vivid actions evidenced by the power of the Bolsheviks, Lenin, and the Union of the Socialist Soviet Republics (the U. S. S. R.). The discussion of the economic policy of the Soviet Government is a criterion for the judgment of similar treatises. *Russia* is a sincere attempt to present the truth.

The *Turkey* of Arnold J. Toynbee and Kenneth P. Kirkwood is among the most keenly discerning books of the present day. Having completed it, one knows who, what, why, and how Turkey is today. One knows how the "sick man" has acquired new life. And one knows it all in a manner so well connected that there is no opportunity for adverse criticism.

Turkey in the process of Westernization is *Turkey*. In order to convey a substantial concept of the remarkable metamorphosis which Turkey has undergone, the authors carefully sketch the Old Ottoman Empire, culminating with the Russian triumph in the Treaty of Kuchuk Kainarja. The roots of the Empire were two—the civilization of nomadic Central Asian stock-breeders and Islam, both essentially non- and anti-Western. Follows a brief descriptive analysis of the Impact of the West, Islam and Christianity, Young Turkey, the World War.

With this brief, excellent outline of historical background *Turkey* leads to the Revolution of 1919–22. The tremendous influences of present Turkish life here find place, the results of the Great War, Mustafa Kemal, the Graeco-Turkish War, the numerous abolitions, of the Capitulations, the Millets, Sultanate, the declaration of the Republic, the further abolitions, of the Caliphate, which had in a measure survived the Sultanate, the mosque schools, Islamic sanction of polygamy, seclusion of woman, the fez—the list is lengthy. Upon the heels of an iconoclastic outburst, the new Republic of Turkey is born, product of international Westernization.

Part III of the book is the New Turkey. Politically, this section considers the Republic and dictatorship, international relations, the problems of the Kurds and of Mosul, Soviet Russia, the Straits,—economically, population, agriculture, railways, commerce, industry, finance,—intellectually, social and cultural questions. An appreciation of geographic environment, especially well presented in the consideration of Turkey's strategic position, adds to the value of the survey.

The Appendix, which includes an English text of the Constitution of the Republic of Turkey, a bibliography of selected works, and a chronological table, the index, and the maps contribute to the certainty that here is a book that may satisfy its authors, after the manner of Thucydides' desire, that their narrative "is favorably received by readers whose object is exact knowledge of facts which have not only actually occurred, but which are destined approximately to repeat themselves in all human probability."

Volumes of the *Modern World* series, *India*, *Norway*, *Russia*, and *Turkey* are remarkably worth-while. As set forth in the valuable introduction accompanying each, it has been the purpose of the editor of the series, the Right Honorable H. A. L. Fisher, M.P., to provide authentic surveys of the political, economic, and intellectual forces which are shaping the destinies of contemporary states. Published or in preparation are other volumes of the series, *Germany*, *Ireland*, *England*, *America*, *Argentina*, *Chile*, *The Arab States*, *China*. Well may one look forward to an intimate acquaintance with each of these superb achievements.

CHARLES GOOZE.

HUNTINGTON, ELLSWORTH. *The Pulse of Progress*. vi and 341 pp.; maps, charts, tables, bibliography, and index. Charles Scribner's Sons, New York, 1926. $5.00. 9 x 6 inches.

Few men of this century have been gifted with such keen vision, such rich imagination, such vibrant joy in research as has Ellsworth Huntington. His active mind has restlessly wandered far and unafraid over the great field of his geographic interests, and from its venturous journeys has formulated a number of broad generalizations regarding the relation of man to his environment that have caught the world's imagination. The study of climate and its effect upon

peoples and their development and history has been his favorite field, and upon that subject he has written a score or more widely read and widely discussed books that have been well-nigh epochal, and over half a hundred stimulating articles. His *Pulse of Asia*, *World Power and Evolution*, *Civilization and Climate*, and *Character of Races* have attracted world-wide attention, and his part in several textbooks have helped to direct study in geography throughout the land.

It is needless to recount the many titles of his published works, except as an index of his indefatigable but joyous labor, as a measure of his productive research. He has been almost as prolific of these as a rabbit of progeny, and only a few have failed to stand the test of time. It is to his credit that he has been as strictly critical of his ideas as his most ardent opponent, and whenever his later researches have indicated the invalidity of an earlier argument, the insufficiency of earlier evidence, he has not hesitated to point out his own errors relentlessly.

In this book, *The Pulse of Progress*, Huntington has summarized the theories and principles, the facts and fancies, of all his previous publications, and added the results of a number of new investigations. Naturally the subject of climate in its relation to mankind is the dominant theme, as it has been the beacon light of his scientific research. Five engrossing and illuminating chapters are devoted to the history of a great race, the Jews, as an illustration of the principles which Huntington has formulated for the last twenty years. Other attractive chapters deal with "The Handicap of Poor Land," "The Sifting Power of Cities," "The Dominance of Nomads," "The Suicide of Russia," etc. In all, his style is lucid, direct, and attractive.

That the author's hope of the book's filling a place as a reference, or supplementary text, in classes in human geography, sociology, oriental and Biblical history, and the philosophy of history is sure of realization, the book itself is ample indication. The ripened fruit of the author's matured judgment, his long years of study and research, his wide travels, and his many intimate contacts with men and peoples, this book will find a warm welcome among scholars and students throughout the world, and make for itself a place in every library for many years to come.

W. ELMER EKBLAW.

NILES, BLAIR. *Black Haiti, a Biography of Africa's Eldest Daughter.* 325 pp. 16 full page illustrations. G. P.. Putnam's Sons, New York. The Knickerbocker Press, 1926.

In *Black Haiti* the author has succeeded in making people live before the eyes of her readers. The life of the Haitians—their joys, sorrows, and superstitions, as well as their workaday activities—has been vividly pictured by presenting with dramatic effect their common and very human virtues and failings. Hence the book differs markedly from the ordinary chronicles of travelers, and it is neither a statistical compendium nor a commercial traveler's guide.

The introductory chapter illustrates how even physiography, that phase of geography which so many students find dry and uninteresting, may be pictured with dramatic power. A single illustration may suffice to make this clear: "This Haiti stands up out of the sea—the highest peak of the submerged mountain range whose summits appear as the islands of the Greater Antilles. . . . To the strange ocean creatures on the floor of this Brownson Deep, Haiti is higher than Mount Everest. It is *Mount Haiti*, rising from the waters with its summit enveloped in air, as the mountain crests of man are often wrapped in cloud."

But the author does not dwell much on physiographic detail, just enough to give the reader the setting for the human drama to be pictured. The first glimpse of the folks of Haiti gives the story of a studious black boy, clad in undersized, battered straw hat and much oversized blue overalls, perched on the edge of a narrow sidewalk of Cape Haitian. The illustration is certainly typical as to color of the subject and fortunate as far as characteristic is concerned for it gives a pleasant mood for the reader's entrance into Haiti. That studiousness is the dominant characteristic of Haitian negroes is open to serious question.

Having thus been given a glimpse of the outstanding physiographic features of the island, and the human aspect presented through the medium of a studious colored boy, one is carried by means of vivid word pictures into the life of the country, varying from the quasi-metropolitan aspects of Port-au-Prince with its sophisticated clubs to the primitive life of the jungle symbolized effectively in "the dance of the creation" performed in the open under the high moon and to the rhythm of the Voodoo drum. The importance of sports in Haitian life is dealt with in an elaborate chapter on the cock fight, a contest found in almost every village or city on the island any Sunday. And then, as though to more vividly bring out the contrast, the cathedrals with their emotional worshippers are brought into strong relief. Thence by swift and dexterous strokes are pictured fields and market places, footpaths, and vehicular highways, villages, and cities, but always with the center of the stage held by folks. The historical background of Haiti is told in charming style, and the reliability of the sketches is vouched for by numerous quotations from sources of high repute.

Only by a very liberal definition may Black Haiti be considered as a geographic treatise—the reviewer prefers to say that it contains considerable material which is susceptible of geographic use. It is interesting, not technical. The bibliography given is well chosen and makes an authoritative list from which additional material may be derived. But most important is the

fact that the author has treated in an interesting and informative way some of the salient aspects of one of the little-known American Republics.

NELS A. BENGTSON.

ETHERTON, P. T. *In the Heart of Asia.* xii and 302 pages. Houghton Mifflin Company, Boston and New York, 1926. $5.00.

In the Heart of Asia, by Lieut.-Colonel Etherton of England is an interesting description of the experiences of the author during several years spent in Central Asia at a time when Russian Bolshevism was at its height. The author was sent into this region by the British Government to counteract the Bolshevik propaganda which was being aimed at India through Central Asia, and in this capacity and later as British Consul-General and Political Resident in Chinese Turkistan he acquired the material for the volume.

Reliable information about the central part of Asia is scarce, and one welcomes a book filled with first-hand impressions about a little known land. The descriptions of the physical conditions of the country, the vegetation and relief are quite vivid, and give the reader a clear picture of the country. Likewise the descriptions of the people, their mode of living, and their customs are very good. To the geographer the general lack of interpretation of the cultural landscape, which is so clearly given, in terms of the environment, which is also clearly shown, is somewhat of a disappointment, and yet the book is interesting in that particular as it leaves the reader a chance to make his own interpretations from the data given. In places the author makes the interpretation when he discusses the effect of relief upon the independent spirit of the Kanjutis tribe (page 20) and again the life of the Kirghiz nomad (page 33). The concluding chapter of the book is of particular interest to the geographer as it is here that the author describes the resources and industries of Chinese Turkistan. Some of the topics discussed in this chapter are the primitive methods of development, oil and petrol, the green jade of Khotan, the future for cotton production, the silk industry, and the demand for wool for Kashmir shawls. While this chapter is a good contribution to the economic geography of Central Asia, the lack of statistics limits its use and makes it suitable only for general reading. The student of Asiatic history will find a wealth of information in regard to the recent history of Turkistan in this volume.

On the whole the book has many good qualities, and is well worth reading by the student of Asiatic geography, but its general rambling nature would prohibit its use as a text or even as a very significant reference book in a course in the Geography of Central Asia.

EDWIN J. FOSCUE.

COLEMAN, A. P. *Ice Ages, Recent and Ancient.* xliii and 283 pp.; maps, illustrations, bibliographies, and indexes. The MacMillan Company, New York, 1926. 9 x 6 inches.

The chief charm of *Ice Ages, Recent and Ancient* is the simple, direct style in which Professor Coleman has presented the technical subject matter with which he deals and made it interesting and intelligent to the casual reader without any sacrifice of scientific accuracy and without any limitation of field; but its chief value lies in its comprehensive summary of all the great mass of literature concerning the phenomena of ice ages and ice action throughout geologic history and over the face of the whole earth.

It is a book that should find a place on the layman's bookshelf as readily as on the table of the professor's study; it should be read by the fundamentalist as well as the evolutionist; it should serve as a reference to the teacher and the student, as well as furnish the professional or business man with an authoritative source book on this great subject.

Three chapters comprising Part I deal with the Pleistocene Ice Age in North America and other regions, and its results. The whole subject is treated inclusively and without subordinating accuracy to brevity; all salient facts are presented. Part II, of ten chapters, treats the Pre-Pleistocene Ice Ages over the whole world from Huronian and even earlier times and the wide distribution of glaciation in late Pre-Cambrian and early Cambrian time, through the Palaeozoic and Mesozoic glaciations, to and including the Cenozoic Ice Ages. The causes of glaciation occupy Part III, of three chapters. This part is most illuminating, and to the student and layman will certainly prove as fascinating as a fairy-tale or a romance. The first of these three chapters presents the features that have to be accounted for, and the closing two chapters recount the geological, atmospheric, and astronomic theories that have been advanced to explain why glaciation has occurred, locally or generally, throughout geological history and in every part of the world.

For the past half century research has gone on apace in the field of glaciology, but so much yet remains to be done that the student who chooses this as his life work will never be at a loss for significant problems to solve. The great ice-caps of Greenland, Ellesmereland, and Antarctica remain practically unknown, yet they constitute a real field laboratory as truly as do Alpine glaciers.

Professor Coleman has been a student of glaciation throughout many years of diligent research, wide travels, and studious consideration of the researches of others. He is himself an authority in the field and competent to judge the value of all that has been done or written. It is because of his eminence, quite as much because of his easy pleasant style and his interesting subject

that his book will be widely read and be permanently authoritative.

W. ELMER EKBLAW.

ESTABROOK, LEON M. *Agricultural Survey of South America: Argentina and Paraguay.* 90 pp.; diagrams, tables, illustrations. Department Bulletin No. 1409, United States Department of Agriculture, Washington, June 1926.

The *Agricultural Survey of South America: Argentina and Paraguay* is the third bulletin in a series by the United States Department of Agriculture on the agricultural situation in these countries from the viewpoint of possibilities of expansion to meet the demand for agricultural produce in those countries whose production does not meet national requirements. This bulletin on Argentina and Paraguay is an outgrowth of extended field work by the author, in all parts of these countries, while he was a representative of the United States Department of Agriculture assigned to Argentina for the purpose of the reorganization of the agricultural statistical bureau of the Republic.

The first thirty pages set forth in short but pertinent paragraphs the outstanding features of the relief, water resources, climate, vegetation, animal life, and population. Then follows a statistical and descriptive treatment of the growth and evolution of the animal industries, and the late but rapid expansion of crop production from a country of little importance to one of the leading world sources of flaxseed, corn, and wheat. The evolution of Argentina agriculture is analyzed in relation to both geographic and economic factors.

The growing importance of Argentina as a source of foodstuffs and raw materials from the farm and the range is clearly portrayed: "Argentina has a cereal region as fertile and as large as the Corn Belt of the United States, but only about 16.2 per cent of this region is under cultivation. Except for limited areas that are too wet for cultivated crops (and areas underlain by a hard pan soil or 'tosca') the whole region is ideal for crop production and can be brought under cultivation merely by breaking the sod." . . . "The agricultural and commercial development of Argentina waits on population and change of organization from a land of large estates with absentee landlords to a system of smaller holdings by families that make their living on the land and contribute by their labor and purchasing power to the development of the country and to the national welfare and prosperity."

The last eighteen pages of the bulletin treat the natural environment and the agricultural activities and possibilities of Paraguay. The economic geographer welcomes such studies as the Agricultural Survey of Argentina and Paraguay.

CLARENCE F. JONES.

SEITZ, DON C. *The Great Island.* xii and 251 pp.; illustrations. The Century Company, New York, 1926. $3.00. 8 x 6 inches.

When a mere newspaper man can crowd so much good geography and good literature into a book so entertaining and popular as *The Great Island*, it is high time that the geographers bestir themselves to present their valuable and interesting material in so attractive a style. American geologists have included among their number many men of literary ability; botany, zoölogy, ornithology, and entomology have boasted many skilled in the fine art of writing; but with the exception of Dr. Ellen C. Semple, and possibly one or two others, American geographers have apparently not been deeply concerned with style, in many cases not even with good construction. It is high time, we repeat, that American geographers give serious thought to their literary style.

The Great Island is probably the most readable book available on Newfoundland. It includes a brief history, an account of the resources and industries, a summary of the political and economic affairs of the island, and some excellent word pictures of the life of the people and of their activities. It is an enjoyable book for an evening's relaxation before the study fire; it is a profitable book for a weary afternoon's ride on a train; it is an educative book for reference in any schoolroom or college. Because he has no axe to grind, no mission to serve, no cause to champion, the author writes naïvely and without restraint, so delightfully that they who read will learn, without knowing that they are taught.

America's knowledge of Newfoundland is, at best, meagre, and generally hazy and inaccurate. Don Seitz's new book will do more than any other book on Newfoundland published, toward enlightening our people, for it certainly will be widely read. The publishers are justified in pushing the sale of this book; it is excellent in almost every way.

W. ELMER EKBLAW.

OUR CONTEMPORARIES

THE GEOGRAPHICAL REVIEW

Vol. XVII, No. 4. October, 1926

Pictures from Southern Brazil. 27 pages. Mark Jefferson.
A popular pictorial presentation.

Queensland and Jamaica: a Comparative Study in Geographical Economics. 20 pages. W. R. Dunlop.
An excellent comparative study of two tropical lands of about equal population, but widely different area and resources.

Oblique Aërial Surveying in Canada. 15 pages. Gerard H. Matthes.
A technical subject lucidly described.

A Famine Zone in Africa: the Sudan. 16 pages. G. T. Renner, Jr.
An exceedingly valuable and well done bit of description of a "pioneer belt"—the great tropical grasslands of the Sudan.

The Problem of Tropical Africa: a Review of Recent Books. 17 pages. H. L. Shantz.
One of the best summaries of the subject ever attempted—just what the title and the author indicate.

Links Between Ancient China and the West. 11 pages. W. Perceval Yetts.
Of particular interest to the anthropogeographer.

A Note on Political Sovereignty and Administration in the Caribbean. 15 pages. Raye R. Platt.
A brief but worthwhile politico-historical article.

Long Lines of Triangulation. 4 pages. William Bowie.
Interesting to the cartographer.

Nontidal Currents in Southeastern Alaska. 5 pages. Frank J. Haight.
New information for the oceanographer.

The Scientific Study of Settlement. 7 pages. Isaiah Bowman.
A scholarly discussion of a proposed project, worthy of strong support.

THE JOURNAL OF GEOGRAPHY

Vol. XXV, No. 6. September, 1926

Twelve Hundred Selected Place Names. 21 pages. Douglas C. Ridgely.
Valuable to the teacher primarily.

An Isolated Industry: Pottery Industry of North Carolina. 6 pages. Ivan Stowe Clark.
Brief but interesting.

The Dependence of the Social Sciences upon Geographic Principles. 8 pages. Ella Jeffries.
A good argument.

A Study of U. S. Fisheries: a Sixth Grade Project. 3 pages. Georgiana Parnell.
A pedagogical paper.

THE JOURNAL OF GEOGRAPHY

Vol. XXV, No. 7. October, 1926

The Cork Oak. 9 pages. W. O. Blanchard.
A good contribution.

Geography in the Junior High School. 8 pages. Maude Cottingham Martin.

Commerce and Industry: Its Place and Function in a Commercial Course. 8 pages. Jessie B. Strate.
A keen appraisal.

Suggestions to Rural School Teachers. 3 pages. Vincent Gatto.

Geography's Affiliations. 6 pages. George T. Renner.
A frank opinion—open to argument and debate!

A Rejoinder to "Geography's Affiliations." 5 pages. O. D. von Engeln.
Another frank opinion—the gage of battle is joined!

THE JOURNAL OF GEOGRAPHY

Vol. XXV, No. 8. November, 1926

France. 23 pages. Amy Ware.
Nothing new, but a valuable time-saver to the overworked teacher.

The Business of Fur Hunting in Canada as an Example of Extractive Industry. 4 pages. John Q. Adams.
Rather well done—brief.

Maps Without Culture: a New Aid in the Teaching of Geography. 3 pages. Dorothy Wyckoff.
The title speaks for itself.

A Normal School Project. 3 pages. George F. Howe.

Agricultural Geography. 2 pages. F. A. Carlson.
A field of increasing value.

THE BULLETIN OF THE GEOGRAPHICAL SOCIETY OF PHILADELPHIA

Vol. XXIV, No. 4. October, 1926

Narrative of a Journey to the Source of Coppermine River. 16 pages. Guy H. Blanchet.
Interesting narrative and description.

The First Steam Voyage to Suez. 10 pages. Halford L. Hoskins.
Historical, almost entirely.

Serpent Legends of the Valais. 6 pages. J. Monroe Thorington.

THE NATIONAL GEOGRAPHIC MAGAZINE

Vol. L, No. 3. September, 1926

Marching Through Georgia Sixty Years After. 53 pages. Ralph A. Graves.
A geographic chronicle and measure of progress.

Flying Over Egypt, Sinai, and Palestine. 42 pages. P. R. C. Groves and J. R. McCrundle.
First hand graphic material of high quality.

Along the Banks of the Colorful Nile. 16 pages. Gervaise Courtellemont.

The First Flight to the North Pole. 19 pages. Richard Evelyn Byrd.

Commander Byrd Receives the Hubbard Gold Medal. 11 pages.

Map of North and South Carolina, Georgia, and Eastern Tennessee. 16 x 20 inches.

THE NATIONAL GEOGRAPHIC MAGAZINE

Vol. L, No. 4. October, 1926

Canada from the Air. 78 pages. J. A. Wilson.
Much of value.

Carnival Days on the Riviera. 34 pages. Maynard Owen Williams.
Excellent pictorial and descriptive geography.

Hunting an Observatory. 15 pages. C. G. Abbot.

THE NATIONAL GEOGRAPHIC MAGAZINE

Vol. L, No. 5. November, 1926

Russia of the Hour. 80 pages. Junius B. Wood.
A timely bit of geographic description.

Guatemala: Land of Volcanoes and Progress. 33 pages. Thomas F. Lee.
An excellent article of much geographic value.

The Land of the Quetzal. 20 illustrations. Jacob Gayer.

ANNOUNCEMENT

THE series of articles, *Agricultural Regions of the World*, is continued in this issue with the second instalment of *Agricultural Regions of North America*, by Dr. O. E. Baker of the United States Bureau of Agricultural Economics. It is richly illustrated by many excellent maps in black and white, presenting the latest agricultural data available. This superb article will be completed in later issues, when another up-to-date colored map and the final textual material will conclude one of the best popular, thoroughly scientific presentations of North American agricultural geography in print, but the next instalment will not appear until July, when important new data will have been tabulated and made available.

Agricultural Regions of South America, by Clarence F. Jones; *of Africa*, by Homer L. Shantz; *of Australia*, by Griffith Taylor; and *of Asia*, by Olof Jonasson, will follow in later issues.

All these articles will be illustrated by maps, charts, and pictures. The series will constitute one of the most complete geographic discussions of the world's agriculture thus far published.

To obtain the complete series of these extremely valuable articles, which present for the first time on such a comprehensive and accurate basis the significant divisions of the world's most important industry, it will be necessary to subscribe at once for ECONOMIC GEOGRAPHY, and date back to the October issue.

In addition to this series of articles on agriculture, an industrial series will be initiated soon; every issue will also contain four or five other articles dealing with urban and regional geography, with problems of land utilization, with programs of development of resources, with commerce, with transportation, with health, and with the hundred and one other subjects that are of present geographic interest, all by the most competent and best informed authorities in their respective fields. ECONOMIC GEOGRAPHY is indispensable to the intelligent citizen.

The subscription price to all charter subscribers in the United States and possessions is $4.00 the year or $7.50 for two years. To all foreign countries, $4.50 the year or $8.50 for two years. On January 1, 1927, the price was increased to $5.00 the year in the United States and possessions; to $5.50 the year in all foreign countries, but all who subscribe before the issue of the April number will be enrolled as charter subscribers at the original price. Address ECONOMIC GEOGRAPHY, Clark University, Worcester, Mass., U. S. A.

ECONOMIC GEOGRAPHY

A QUARTERLY journal of Economic Geography published by Clark University for the benefit of geographers, economists, teachers, professional and business men, and all who are interested in the intelligent utilization of the world's resources.

Subscription, after January 1, 1927, $5.00 the year in the United States and its Territories; $5.50 the year beyond the borders of the United States, except to charter subscribers.

Only a limited number of the first volumes of ECONOMIC GEOGRAPHY are available. Back numbers of Volume II for the year 1926 include the following articles:

January includes:

The Development, Strategy, and Traffic of the Illinois Central System, C. H. Markham, President, Illinois Central System.
The Agricultural Regions of Europe, Olof Jonasson, Geographic Institute of Stockholm, Sweden.
The Present Economic Condition of Germany, Bruno F. A. Dietrich, University of Breslau.
The Cranberry Industry in Massachusetts, Carol Y. Mason, University of Illinois.
The British Fisheries, Ll. Rodwell Jones, University of London.
The Regional Geography of Anatolia, Gordon P. Merriam.
Geographic Factors in the Trinidad Coconut Industry, Preston E. James, University of Michigan.

April includes:

The Character and Distribution of South American Trade, Clarence F. Jones, Clark University.
The Water-Power Resources of Canada, M. J. Patton, Natural Resources Intelligence Service, Canada.
The Agriculture of the Eastern Shore Country, Maryland, Paul F. Gemmill, University of Pennsylvania.
Sugar Production of Czechoslovakia, Bessie C. Engle.
The Import Trade of the United States, G. B. Roorbach, Harvard University.
The Landes: Reclaimed Waste Lands of France, W. O. Blanchard, University of Illinois.
The Geographic Regions of the Sudan, George T. Renner, Columbia University.
The Significance of Lake Transportation to the Grain Traffic of Chicago, Richard Hartshorne, University of Minnesota.
The Green County, Wisconsin, Foreign Cheese Industry, Glenn T. Trewartha, University of Wisconsin.

July includes:

The Handicap of Poor Land, Ellsworth Huntington, Yale University.
Argentine Trade Developments, Clarence F. Jones, Clark University.
Forest Resources of Canada, Roland D. Craig, Dominion Forest Service.
Transhumance in the Sheep Industry of the Salt Lake Region, Langdon White, University of Pittsburgh.
Oklahoma—An Example of Arrested Development, Charles N. Gould, State Geologist, Oklahoma.

October includes:

Agricultural Regions of North America, Oliver E. Baker, U. S. Dept. of Agriculture.
Caribbean Tropics in Commercial Transition, Victor M. Cutter, President, United Fruit Company.
Economic Regions of Alaska, L. A. Wolfanger, Columbia University.
The Laurentian Plateau in Canadian Economic Development, W. A. Mackintosh, Queen's University.
Evolution of Brazilian Commerce, Clarence F. Jones, Clark University.

Copies of these numbers will be sent to any American address for $1.50 each; to any foreign address for $1.75.

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